Environmental Assessment
Findings of No Significant Impact

Proposed Maintenance Dredging of
the Rye Harbor Federal Channel
Rye Harbor, New Hampshire

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I. Environmental Assessment

A. Introduction

Rye Harbor is a small (40 acre) estuarine embayment of New Hampshire's coastline. It is located approximately five miles south of Portsmouth Harbor and thirteen miles north of the Merrimack River (see Figure 1). The proposed maintenance dredging involves the removal of about 85,000 cubic yards of sandy-silt with disposal at the Cape Arundel Disposal Site (CADS) (see Figure 2). This maintenance dredging will return the Federal channel and anchorages and the existing state anchorage to their designated operating depths.

B. Project Design

1) Project Need

Dredging in the Rye Harbor channel is being undertaken to provide safe operating depths for commercial and recreational vessels using the harbor. The authorized depths in the channel and anchorages are 8 and 6 feet respectively with a 10 foot outer channel. The harbor supports both commercial and recreational industries that yearly handle 30,000 head and tour-boat passengers, and land approximately 2 million pounds of finfish and 150,000 pounds of lobsters annually. Additionally, 108 recreational vessels are moored in the harbor. Many of these vessels require 6 to 8 feet of water for safe navigation.

2) Authority

The existing Federal project was authorized by the River and Harbor Act of July 14, 1960 (H. Doc. 439, 86th Cong., 2d Sess.). This environmental assessment is being written in accordance with all environmental Statutes and Executive Orders as described in the Compliance Table (Section I.) to fulfill the intent of the National Environmental Policy Act.

3) Associated Activities

This document assesses the environmental impacts of the proposed maintenance dredging of the Federal channel and anchorages and the existing state anchorage. Maintenance dredging of the existing state anchorage will be performed under the same contract as the Federal project as noted in a Memorandum of Agreement between the Corps and the State of New Hampshire, Department of Resources and Economic Development. The following party has submitted a permit request to the Corps of Engineers to perform dredging in Rye Harbor concurrently or subsequent to the Federal work:

Mr. Stephen Foss of Fairway Drive, Rye Beach, New Hampshire proposes to maintain his existing 50 foot wide and 300 foot long channel (see Figure 1).

These activities (Federal and non-Federal) will generate a total of about 85,000 cubic yards of material.

C. Project Description

1) Dredging

Dredging of the channel and anchorages will remove sediment that has accumulated since the project was constructed in 1962. A mechanical (bucket) dredge will remove the material and transport it via barge to the disposal site. The present controlling depths are 7 feet in the entrance channel, 5 feet in the harbor channel, 4 feet in the north anchorage and 6 feet in the south anchorage. Dredging will restore the project to the authorized dimensions of 10 feet deep, 100 feet wide in the entrance channel; 8 feet deep, 100 feet wide in the harbor channel; 6 feet deep in the 5 acre north anchorage; and 8 feet deep in the 5 acre south anchorage (Figure 1). The maintenance dredging will be performed during the spring or fall in the year funds become available and the associated activities (see Section B3) are anticipated to coincide with this project.

2) Disposal Site

The proposed disposal site (see Figure 2) for the material to be dredged from Rye Harbor is the Cape Arundel Disposal Site (CADS). This site is an EPA designated interim Ocean Disposal site for dredged material. The site is a 500 yard diameter circle with a center at 43°17.8' North latitude and 70°27.2' West longitude. It is located approximately 2.6 nautical miles south-southeast of Cape Arundel and 3.2 nautical miles east of Wells, Maine.

The water column depths within the site range from 90 to 105 feet mean low water (MLW). The authorized disposal point (within the overall disposal area) is specified for each project. The New England Division will specify the point of disposal by deploying an appropriate buoy as well as providing onboard inspectors to ensure proper positioning of the barge at the time of disposal.

D. Alternatives

1) No Action

Failure to dredge the Rye Harbor project will restrict commercial and recreational navigation in the channels during the lower stages of the tide as well as reduce the area available for anchorage. These restrictions to navigation associated with the "No Action" alternative would negatively impact the harbor's fishing and tourism trades which makes this alternative unacceptable. In 1983, a New England Division survey found Rye Harbor to contain:

a) 4 head boats, 1 tour boat: 30,000 passengers per year.
b) 7-8 full time finfish boats: 2 million lbs/year.
c) 20 full time lobster boats: 150,000 lbs./year.
d) 108 recreational boats

2) Proposed Dredging.

The proposed dredging will be accomplished by a mechanical (bucket) dredge loading directly into a barge. The use of this type of equipment would be more efficient than hydraulic dredging, which would require barge overflow of the slurry to fill the hopper. Hydraulic dredging produces the least amount of sediment resuspension of all the dredging types at the cutterhead, but the overflow barge loading produces unacceptable levels of suspended solids when dredging fine-grained sediments. Mechanical loading of the barges is therefore the most economical and environmentally practical method.

The present configuration of the channel and anchorages makes maximum use of the harbor area. Safe anchorage area is scarce along this section of the coastline so all available space is utilized. Reducing the extent of the dredging would restrict the use of those sections of the project left undredged without significantly reducing the impacts of dredging and disposal.

3) Proposed Disposal

The proposed disposal of materials dredged from the Rye Harbor channel and anchorages will be at an EPA interim designated ocean disposal site for dredged material; the Cape Arundel Disposal Site. In 1986, an upland site was proposed for use as a disposal area for the Rye Harbor dredged material. This site is immediately northwest of Route 1A near Rye Harbor in Rye, New Hampshire. This proposed disposal site was filled in 1941 with the material from State dredging and again in 1962 from Federal improvement dredging. On 30 April 1988, New Hampshire Governor John Sununu signed into law HB794 (Capital Budget for the Department of Resources and Economic Development). Attached to this budget was an amendment which says "the Department of Resources and Economic Development shall not dump any dredge materials resulting from the projects authorized in section I,IX,B,2 in any areas west of New Hampshire Route 1A."

Based on the actions of the legislature and the Governor, the Department of Resources and Economic Development no longer has the authority to allow disposing of material that will be removed from the Rye Harbor dredging project in the original disposal area.

Also, Article 16 on the Town of Rye's 1988 town meeting stated as follows: "To see if the town will vote to affirm its position that the dredge material from any and all dredgings of Rye Harbor NOT be placed on the thirteen acre wetland site west of Rye Harbor, designated as former disposal site. It was moved by Susan Elsea, seconded by John Coffey, to adopt Article 16. Article 16 was adopted.

Based on these legislations, this upland site is no longer available for use in this proposed project. The only practical alternatives would be ocean disposal or another land based disposal site. Sites for dewatering/staging areas for transfer of dredged material to trucks for further upland transport have not been identified in the immediate project vicinity and the dewatering itself will have its own inherent environmental impacts. Additionally, no nearby upland sites are available and transfer/transport costs prohibit this alternative.

Coordination with the State of New Hampshire has revealed their preference for use of an ocean site. Disposal of dredged material in coastal waters is an environmentally acceptable alternative if appropriate upland sites are not available. Therefore, CADS is the preferred alternative under the Federal standard, which represents the least costly alternative consistent with sound engineering practices and meeting the environmental standards established by the ocean dumping criteria (33 CFR 335.7).

E. Affected Environment

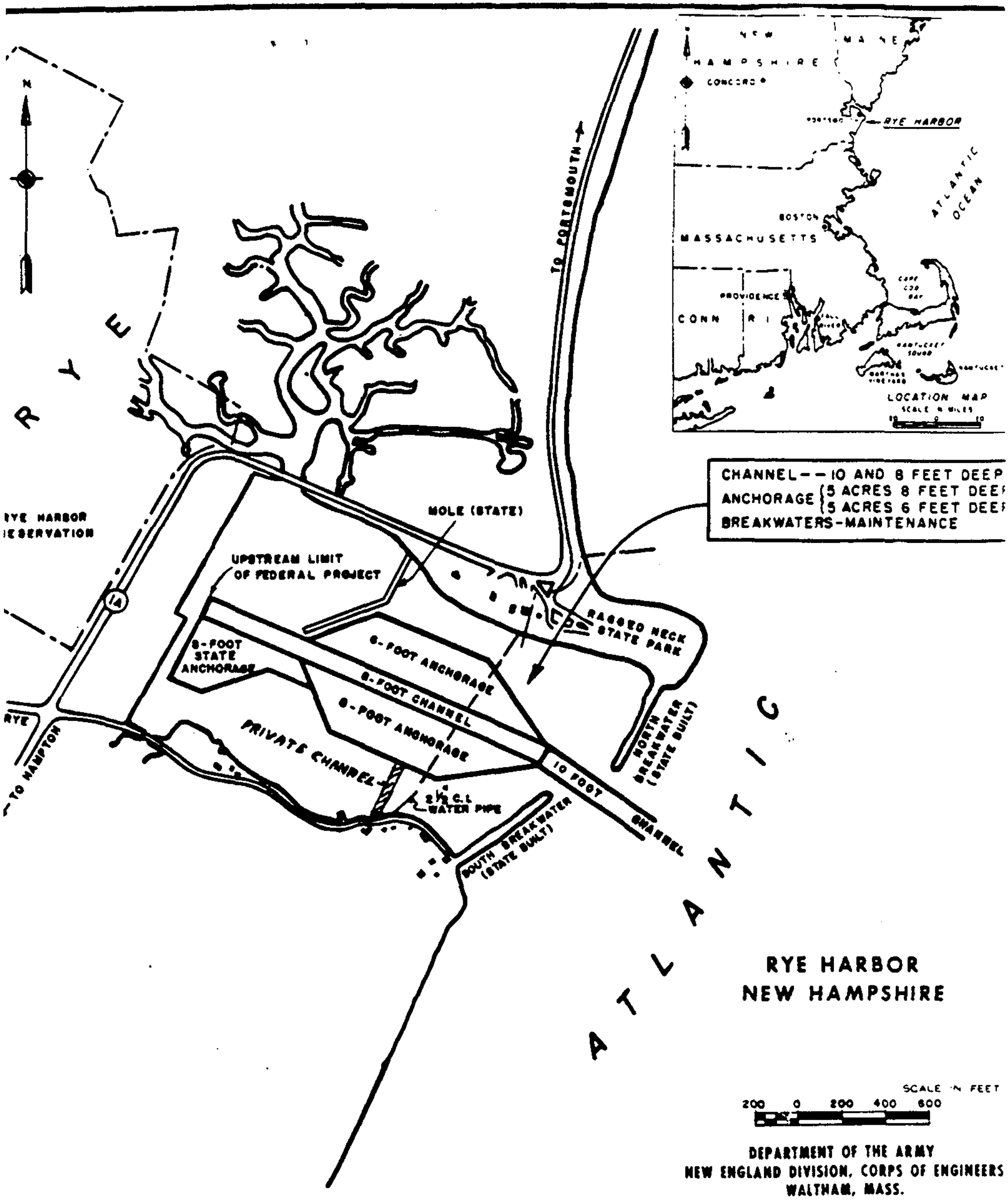
1) Dredging Site

a. General

Rye Harbor, New Hampshire is an approximately 40 acre embayment located 5 miles south of Portsmouth Harbor and 13 miles north of the mouth of the Merrimac River (Figure 1). Two breakwaters, constructed by the State, isolate this estuarine embayment from the open Atlantic Ocean. The North Breakwater extends southwesterly from Ragged Neck State Park. The South Breakwater extends northeasterly from Rye Harbor Point. A 200 foot passage exists between these two breakwaters where the 10 foot deep channel enters the harbor. This channel is 100 feet wide extending 600 feet northwest through the harbor entrance. The channel then extends 1700 feet west-northwest and has an authorized depth of 8 feet. Adjacent to the 8 foot deep channel are two 5 acre anchorage areas. The anchorage area north of the channel has a 6 foot authorized depth and the south anchorage is authorized to be 8 feet deep.

b. Physical and Chemical Environment

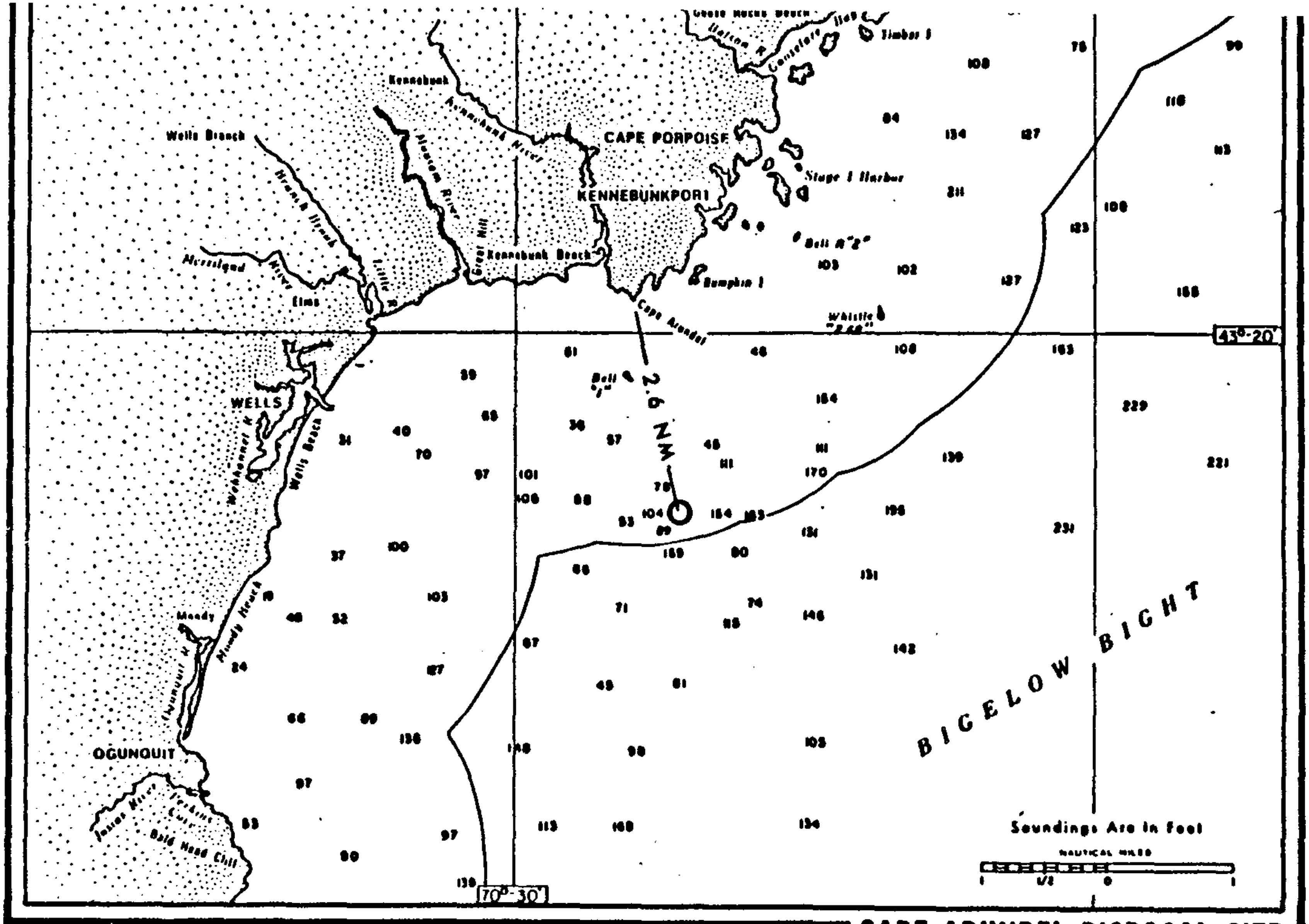
A 1986 hydrographic survey has shown the 10 foot entrance channel to have shoal areas as shallow as 7.3 feet at Mean Low Water (MLW). The 8 foot channel has a controlling depth of 5 to 6 feet MLW. Where the 8 foot Federal channel ends at the head of the harbor, shoals are as shallow as 2 feet MLW. Hydrographic surveys in the 6 foot anchorage detected 4 to 5 foot MLW depths with shoals as shallow as 1.5 feet. The 8 foot anchorage area had 6 to 7 foot MLW depths with shoals as shallow as 2.1 feet.



RYE
RYE HARBOR RESERVATION
TO PORTSMOUTH
UPSTREAM LIMIT OF FEDERAL PROJECT
MOLE (STATE)
RAGGED NECK STATE PARK
8-FOOT STATE ANCHORAGE
6-FOOT ANCHORAGE
8-FOOT CHANNEL
8-FOOT ANCHORAGE
PRIVATE CHANNEL
10 FOOT CHANNEL
NORTH BREAKWATER (STATE BUILT)
SOUTH BREAKWATER (STATE BUILT)
TO HAMPTON
ATLANTIC
CHANNEL — 10 AND 8 FEET DEEP
ANCHORAGE 5 ACRES 8 FEET DEEP
5 ACRES 6 FEET DEEP
BREAKWATERS-MAINTENANCE
NEW HAMPSHIRE
MAINE
RYE HARBOR
BOSTON
MASSACHUSETTS
PROVIDENCE
CONN
R I
ATLANTIC OCEAN
LOCATION MAP
RYE HARBOR
NEW HAMPSHIRE
SCALE IN FEET
200 0 200 400 600
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

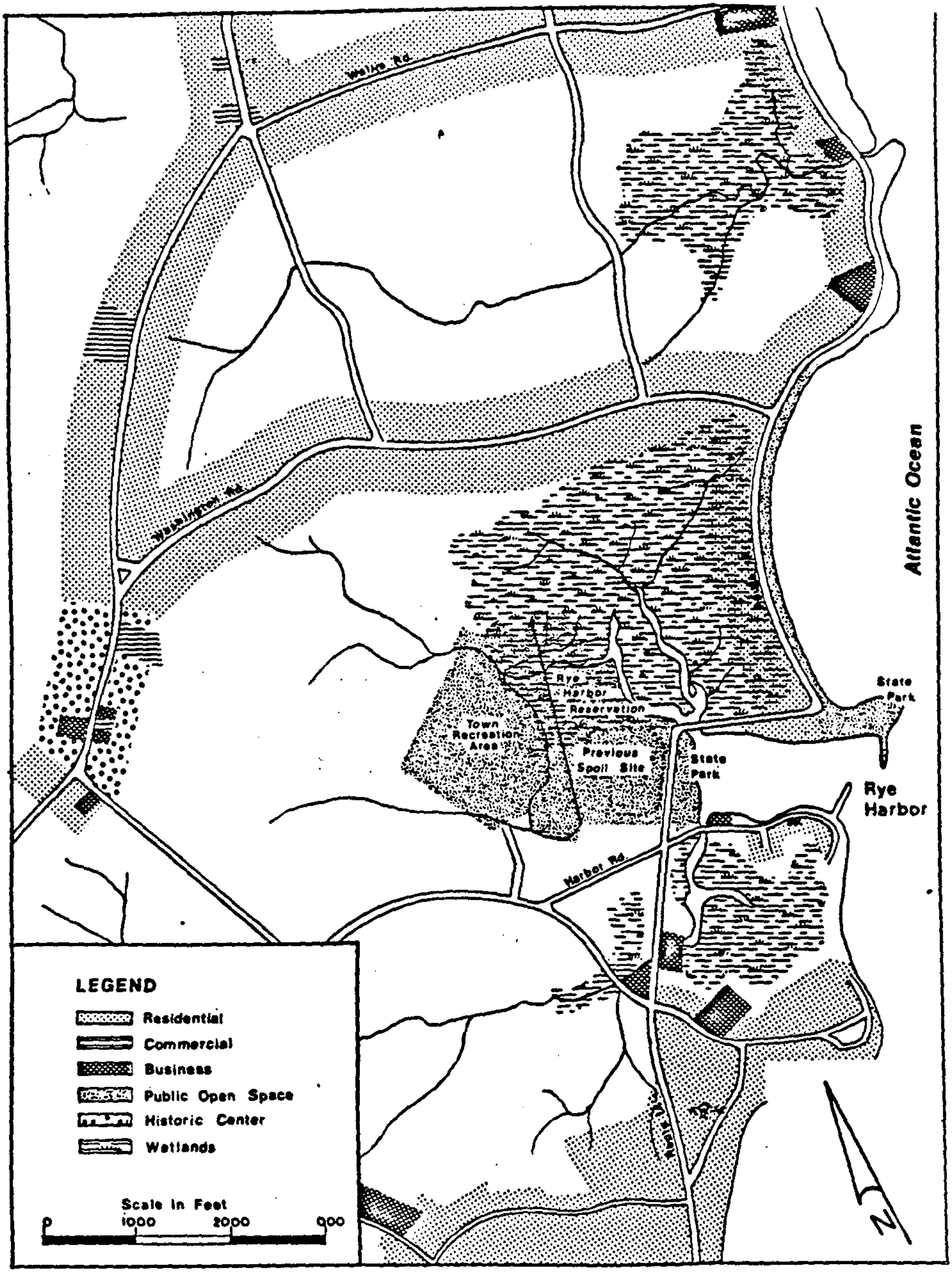
Figure 1

Figure 2



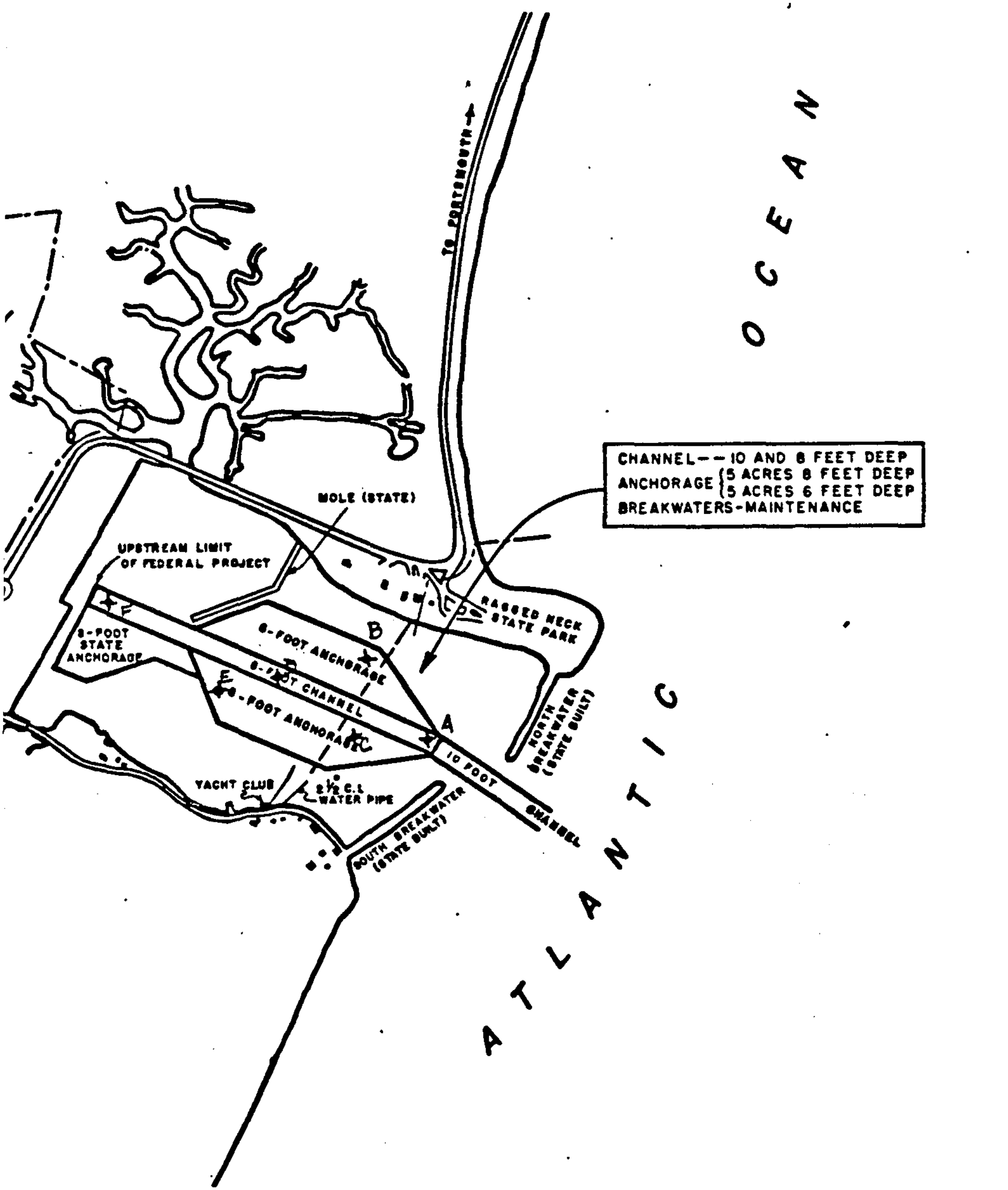
CAPE ARUNDEL DISPOSAL SITE

Description: This site is a 500 yard diameter circle with center at 43°-17.8'N latitude and 70°-27.2' W longitude. From the center, Lighted Bell Buoy "1" bears true 339° 30' at 3,708 yards, Lighted Whistle Buoy "2CP" bears true 49° at 7,416 yards, and Bell Buoy R "2" bears true 23° at 7,622 yards. Depth Range: 90 to 105 feet MLW. The authorized disposal point (within the overall disposal area) is specified for each dredging project in other project documents that also restrict site approach and departure to specified lanes. NOTE: The map depicts the disposal site's location in relation to landmarks. It is not intended for use in navigation.



Land Use - Rye Harbor, New Hampshire

Figure 3



OCEAN
ATLANTIC
TO PORTSMOUTH
CHANNEL--10 AND 8 FEET DEEP
ANCHORAGE {5 ACRES 8 FEET DEEP
5 ACRES 6 FEET DEEP
BREAKWATERS-MAINTENANCE
MOLE (STATE)
UPSTREAM LIMIT OF FEDERAL PROJECT
RAGGED NECK STATE PARK
8-FOOT STATE ANCHORAGE
6-FOOT ANCHORAGE
8-FOOT CHANNEL
8-FOOT ANCHORAGE
10 FOOT CHANNEL
NORTH BREAKWATER (STATE BUILT)
SOUTH BREAKWATER (STATE BUILT)
YACHT CLUB
2½ C.I. WATER PIPE
A
B
C
D
E
F

Figure 4

In March 1985 sediment samples were obtained from six stations ("A"-"F") in the harbor (Figure 4) and analyzed for physical and chemical parameters. Stations A and B were dominated by fine sand and stations C, D, E, and F were predominantly silt (that material passing through a #200 standard sieve). As described below the sediments analyzed from Rye Harbor were predominantly low in levels (N.E.G.C, 1982) of contaminants, including Polychlorinated Biphenyl (PCB) compounds which were detectable but in low concentrations. PCB's are discussed separately at the end of this section.

Station A, located at the harbor entrance in the eastern end of the 8 foot channel, contained only 3% fine material and therefore was not analyzed for chemical content. This 97% sand material does not contain sufficient fine grained particles to adsorb chemicals. This material is considered clean and is well scoured due to its exposure to wave and tidal forces at the harbor mouth.

Station B, located in the eastern section of the 6 foot anchorage, was found to be predominantly fine sand, but contained a sufficient silt fraction (47%) to be analyzed for chemical constituents. This silty sand contained low levels of all chemicals and moderate levels of volatile solids and mercury (see Appendix I). The levels were still very low (5.7% and 0.12 ppm respectively).

Station C contained 72% silt and low concentrations of all chemical constituents except for moderate (4.0 ppm) cadmium levels. This station was located in the eastern section of the 8 foot channel. Volatile solids and mercury were the only moderate values of chemicals found at this station (5.52% and 0.19 ppm respectively).

Station D was located in the center of the harbor in the 8 foot channel. It was composed of 75% fine grained materials. All chemicals were in low concentrations except for moderate (5.52 %) levels of volatile solids.

Station E located at the head of the 8 foot anchorage area contained 75% silt. This station had moderate levels of only volatile solids (8.21%).

Station F located in the 8 foot channel at the head of the harbor, near the State pier, was also dominated (85%) by fine silt particles. Percent volatile solids (11.44%) were the only high chemical values for this station.

The State of New Hampshire's Use Classification and Water Quality Standards designate Rye Harbor, for optimum use, as Class B. This use classification is for waters of quality that is acceptable for swimming and other recreation, fish habitat, and after adequate treatment, for use as water supplies. No disposal of sewage or waste is allowed unless adequately treated. The waters have high aesthetic value. More specific criteria are: $\geq$ 6 ppm dissolved oxygen; $\leq$ 70 coliforms (bacteria) per 100 ml; 6.5-8.0 range of pH; no toxic kinds or unreasonable quantities of toxic substances, sludge deposits, oil and grease, color, phosphates or solids. This classification restricts turbidity to $\leq$ 25 standard turbidity units, phenols to 0.001 ppm. and temperature to reasonable controls. Radioactivity measurements for Class B waters restrict gross Beta to $\leq$ 1000 picocuries per liter, strontium-90 to $\leq$ 10 picocuries per liter and Radium-226 to $\leq$ 3 picocuries per liter.

PCBs

Polychlorinated Biphenyl compounds were found at all stations sampled in Rye Harbor, with the exception of Station A, which does not contain sufficient fine grained sediments to analyze. The levels ranged from 80 ppb at station B to 610 ppb at Station F with a mean of 306 ppb (S.D. = 216.2). These levels are considered low for dredged material disposal. Water chemistry performed as part of the elutriate testing defined ambient PCB levels in the harbor to be greater than the 0.03 ppb EPA criteria (see F. Environmental Consequences).

c. Biological Environment

Rye Harbor is an estuarine embayment of the New Hampshire coast. All of the harbor has large riprap boulders stabilizing the intertidal/ upland interfaces. The intertidal zones are predominantly cobble with some pocket marshes and small areas of sand. Standing at the head of the harbor, e.g. the State pier, there is obvious symmetry between the northern and southern shorelines of the harbor. Both areas have extensive marshes draining into them under access roads (Route 1A bridge and Harbor Point Road bridge). These areas have minimal flow and depth at low tide. Where these marsh creeks enter the harbor, small stands of cordgrass, Spartina alterniflora, are eroding. Sandy and cobble intertidal flats fringe the harbor with riprapped shoreline borders.

The northern shoreline was chosen for quantitative field investigations because of its proximity to Route 1A and a State Park. The southern shoreline of this harbor is mostly private. Sampling was conducted on 26 August 1985. The quantitative results from sampling of the north shore is assumed qualitatively applicable to the southern shoreline.

The intertidal habitat of Rye Harbor is dominated by the periwinkle, Littorina littorea (87.8 per square meter), on silty-sand substrates and the blue mussel, Mytilus edulis (34.2 per square meter), on the cobbly-sand substrates. The dominant macrobenthic infaunal component of this estuary is the soft-shelled clam, Mya arenaria, which is present in low densities (1.85 per square meter, 6.15 cm average length from Ni=2). The dominant flora consists of a small Spartina alterniflora (266.8m^2) stand at the head of the harbor and various seaweeds, predominantly Fucus vesiculosus and Ascophyllum nodosum. Additionally, an intertidal Zostera marina (eelgrass) panne (depression) has developed behind the mole breakwater. (See Appendix II - Biological Report).

In general, the intertidal areas of Rye Harbor, New Hampshire, are cobbly-sand substrate. The common periwinkle, Littorina littorea and the mussel, Mytilus edulis are present in various densities. The steamer or soft-shell clam is present at some stations, but not in significant densities.

A 5-minute bird census on 26 August 1985, at mid-ebb tide, identified 9 resting cormorants, Phalacrocorax auritus, 8 black-backed gulls, Larus marinus, 2 second year herring gulls and 52 mature herring gulls, Larus argentatus. The only other shorebird species observed in Rye Harbor was Charadrius semipalmatus, the semipalmated plover, a pair of which were feeding on the flats at low tide.

Subtidal Ecology

The sandy-silt and fine sand substrates present subtidally in the channel areas of Rye Harbor have been reported to contain moderately diverse (mean Shannon Diversity Index = H = 0.527) assemblages of infaunal macrobenthic invertebrates (Cortell, 1977). This community is dominated numerically by the polychaetes Cirratulus sp. and Clymenella torquata (Cortell, 1977). It has been well documented that benthic organisms serve as a major link between primary producers and other trophic consumers (Flint, 1985). The benthic communities that occupy sandy estuarine sediments are a diverse interrelation of species and guilds and are highly tolerant of the dynamic tidal and wave induced currents in the harbor.

The harbor itself does not support any significant finfishery, with the exception of smelt. Smelt (Osmeridae) are anadromous organisms that swim upriver from the Atlantic Ocean to spawn in freshwater. The Atlantic species of concern is rainbow smelt, Osmerus mordax which enters fresh or brackish areas, such as the tidal marsh rivers northerly of Rye Harbor, to spawn. This occurs in late winter or early spring.

Lobsters (Homarus americanus) are not potted for in the harbor due to navigational constraints. The Cortell (1977) study identified lobster as being present in the harbor, but did not report density.

2) Disposal Site

a. Physical and Chemical Environment

The proposed disposal site has been used in the past for the disposal of dredged material, principally from the Kennebunk River, Maine. A recent site investigation found the majority of this site to consist of a hard bottom characterized by numerous rock outcroppings and boulders. This investigation consisted of a detailed bathymetric survey, sidescan sonar survey and bottom sampling to obtain a visual description of the material. It also revealed a 90-120 foot deep trough with a north to south orientation extending from the northern portion of the above described circle (SAIC 1984). Side scan data and bottom sampling revealed a soft substrate on the floor of the trough. The disposal point will be over this trough within the limits of the circle shown in Figure 2.

Physical oceanographic investigations in the vicinity of the CADS site depicts isothermal water column winter conditions of 6°C and a stratified summer condition with a strong 60 to 90 feet deep thermocline. Bottom currents vary seasonally with a southerly tidal current drift of 10-15 cm/sec. Infrequently, major storm events impart persistent bottom currents southerly at 30-40 cm/sec. Long period (9-10 second) waves may also increase bottom currents, but only occur once every 3-5 years. These determinations indicate CADS is a containment area suitable for the disposal of dredged material.

The disposal point is located in a 600-foot wide trough with a cobble apron grading into a rock ridge to the east and west. The disposal site trough is characterized as having a fine sand substrate with silt in the vicinity of disposal deposits.

Chemically, the sediments and water column show low concentrations of all chemical contaminants at CADS (see Appendix IV). The only contaminant concentration in the sediment detected above ambient concentrations was oil and grease at approximately 300 ppm. This is not an anomalously high value, but reflective of the recent deposition of dredged material from the Kennebunkport River channel. Analysis of the chemical contaminant residue in the tissues of resident benthos (Nephtys incisa, Arctica islandica and Mytilus edulis) also indicate the area is not significantly contaminated as a result of previous dredged material disposal.

b. Biological Environment

The biological environment at CADS was characterized using manned submersible observations, sediment-water interface profiling cameras, demersal gillnets and $0.1m^2$ Smith-McIntyre grabs (SAIC, 1986).

The disposal area at CADS contained an average of 70 species $/m^2$ and 16.5k individuals $/m^2$. The benthic community is dominated by oligochaets and the burrowing polychaete Sternaspis fossor and the bivalve Nucula annulata (see Appendix A). The sediment water interface photographs (digitally analyzed) indicate this "pioneering" benthic assemblage was present in the area of dredged material disposals.

Finfish samples were dominated by the spiny dogfish, Squalus acanthias, but other species recovered include butterfish, Peprilus triacanthus; lobster, Homarus americanus; smooth skate, Raja senta; red hake, Urophysis chuss, silver hake, Merluccius bilinearis; and various flounder.

3. Threatened and Endangered Species

Rye Harbor and the Cape Arundel Disposal site are not known to contain any Federally listed endangered or threatened species (see H. Coordination). The habitats associated with this project are also not considered to be critical habitat for any Federally listed threatened or endangered species.

4. Ecologically Significant Species

Three ecologically significant species that may be encountered in Rye Harbor are the steamer or soft-shelled clam Mya arenaria, the lobster, Homarus americanus and the smelt, Osmarus mordax (Cortell, 1977). Dredging of Rye Harbor would be scheduled to avoid adverse impacts on the larval and spawning organisms of these species.

The soft-shelled clam, Mya arenaria would be expected to be found in greatest densities in the mid to low intertidal zones through the subtidal areas. Sampling of these components of the Rye Harbor ecosystem revealed low densities of Mya arenaria (see E.1). This species is tolerant of the turbidities in an estuarine system and would not be significantly impacted during dredging.

The lobster, Homarus americanus, can be expected to inhabit mud burrows along the channel and anchorage banks (Cortell, 1977). These motile organisms would be expected to forage the flooded intertidal areas at high tides during the night. These organisms would avoid dredging activities.

The smelt, Osmarus mordax, are anadromous residents of the New Hampshire coast. They are seasonal in occurrence, spawning in late winter and early spring. They move offshore toward cooler waters in the summer. They are not residents of the harbor, only transient users.

5. Historic and Archaeological Resources

There are not any historic architectural or archaeological resources in the dredging or disposal areas.

6. Social and Economic Resources

Rye Harbor supports commercial fisheries, recreational fisheries, boating and tourism. The harbor area includes a State park and a State dock with associated boat launching capabilities.

New Hampshire Marine Services reports four fishing charter (head) boats and a tour boat operating seasonally in the harbor. These vessels carry approximately 30,000 passengers annually. There are approximately seven full time finfish trawlers/gill netters operating out of Rye. These vessels land approximately 2 million pounds of finfish per year. There are 20 full time lobster boats offloading approximately 150,000 pounds of lobster per year and 108 recreational boats moored here.

F. Environmental Consequences

1. Dredging Site

a. Dredging the channel and anchorages of Rye Harbor will be accomplished using a mechanical dredge. The channel will be restored to its authorized 8 and 10 foot depths (Figure 1). The anchorage north of the channel will be restored to a 8 foot depth at Mean Low Water (MLW) and the anchorage south of the channel will be dredged to 6 feet at MLW. The dredging is regulated under Section 10 of the Rivers and Harbor Act of 1899.

b. Physical and Chemical Effects

The dredging of sediments that have accumulated in the Rye Harbor channel and anchorages will increase turbidity in the immediate vicinity of the dredge by resuspension of the finer (silt-clay fraction) sediments into the water column. The mechanical dredging system will remove sediments in a cohesive mass and deposit directly into a barge for transport to the disposal site. The resuspension of sediments will increase water column turbidity and potentially the elution of chemicals absorbed to the sediment particles, especially the silt-clay (>74phi) component (Wechsler and Cogley, 1977). The effects of suspended silt on water quality are of short duration and localized to the immediate dredge site (Bohlen, 1979).

While suspended, silt increases water turbidity levels. High levels of turbidity reduces vision and masks odors important to foraging organisms. Suspended silts may also clog or abrade gill structures and interfere with feeding mechanisms of filter feeders. The usually high organic content of silt-clay material would reduce ambient dissolved oxygen concentration. Increased turbidity would also reduce light penetration lessening primary productivity and therefore oxygen release from primary producers would be reduced. Finally, upon settling, the suspended sediment load could cover non-motile plants and animals.

The level of turbidity generated from a dredging operation is controlled by many factors including characteristics of the sediment, hydrologic regime and hydrodynamic forces. Barnard (1978) reported maximum suspended solid concentrations (which cause turbidity) as high as tens of grams per liter, decreasing exponentially with depth/distance from the dredge. Near-bottom suspended solids concentrations may be elevated to a few hundred milligrams per liter at 350 meters from the activity. Recent investigations (Raymond, 1984) have found average sediment resuspension within 18 meters of the dredge to be less than 1000 mg/l.

Scientific analysis of the spatial and temporal persistence of the turbidity/organic plume was performed in 1977 for bucket dredging in the New London Harbor and Thames River channels in New London, Connecticut (Bohlen et. al., 1979). The conclusions of this study defined the plume of suspended materials from the dredging operation as having a maximum extent of 700 meters downstream (tidal flow). Analysis of the composition and concentration of the plume indicated the majority of the material suspended occurred within 300 meters of the dredge. Suspended material concentrations were reduced by a factor of ten within the first 200 meters downstream of the dredge. Surface concentrations returned to normal 250 meters downstream of the dredge. Mid-water and near bottom concentrations returned to background levels 700 meters downstream of the dredge. All values for the sediment resuspension levels from the bucket dredge were significantly less than some storm induced perturbations.

All of the effects associated with increased turbidity would occur in the immediate area of the dredge, be transported by tidal currents and settle. The motile organisms (e.g. finfish and crustacea) will escape these impacts by leaving or avoiding the activity area. The remaining organisms (e.g. benthos) will be impacted. These organisms are estuarine species that are tolerant of many stresses and should be able to tolerate the impacts associated with dredging induced turbidities.

One of the functional characteristics of an estuarine system is to serve as a nutrient retention area, increasing the productivity of its subcomponents. Nutrients are effectively "trapped" in the sediments where they are stored. This trapping and storage function also allows for the retention of contaminants in the same substrates, especially in fine grained sediments which have a large volume of surface area for pollutant adsorption. The physical removal of these sediments by dredging operations has the potential to release some of the sediment bound chemical pollutants.

Analyses of the chemical constituents from 6 samples taken in 1984 from Rye Harbor indicates little potential for chemical contamination from sediment resuspension other than from Polychlorinated Biphenyls. There would be little opportunity for significant releases of toxics into Rye Harbor since the dredging operation would be of relatively short duration and tests indicated significant contaminant concentrations do not exist in the material to be dredged.

One group of contaminants that have been of concern for environmental quality analyses are metals such as mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb) and zinc (Zn). Recent studies have shown that even when metals are found in high concentrations, there does not exist a corresponding substantial release of free (non-bound) metals from resuspension of bottom sediments during dredging. Studies performed by the U.S. Army Corps of Engineers Dredged Material Research Program concluded that certain trace metals may be released in the parts per billion (ppb) range, while others show no release pattern (Chen, 1976). This research also demonstrated that heavy metals are not readibly soluble or excessively mobile through a system since they are usually absorbed to the sediments or coprecipitated out of solution. These chemicals are not present in high concentrations and therefore the proposed project will not release them in significant amounts.

Other classes of toxicants that are of concern are PCBs (Poly Chlorinated Biphenyls), PHCs (Petroleum Hydrocarbons) and DDT (Dichloro-Diphenyl-Trichloroethane: a chlorinated pesticide). Fulk et. al. (1975) demonstrated the solution of pesticides from the bottom sediments into the water column during dredging is not significant. Rye Harbor sediments are not anticipated to contain pesticides and in fact contain no detectable levels of DDT. Petroleum Hydrocarbons are a byproduct of industrialization of estuarine areas and fossil fuel combustions. PHCs are detrimental to the ecosystem only when released in very high concentrations. These concentrations are not found in Rye Harbor. Concentrations of PCBs were slightly elevated in sediment and elutriate testing in Rye Harbor (see Appendix I). The effects of mechanical dredging in suspension of PCB absorbed sediments would be considerably less than the possible elution and discharge from the disposal site as discussed in 2. Disposal Site b.

Sediment samples were analyzed for physical and chemical parameters and elutriate testing from the Rye Harbor channel and anchorages (see Figure 4). The material to be dredged is silty-sand and sand. There were no elevated levels of contaminants in any of the samples except PCBs. The impacts associated with dredging will not be significant since there does not exist a potential for contaminant release from the substrate.

The dredging operation may suspend anaerobic sediments and release small amounts of hydrogen sulfide (H_2S) gas. These releases would lower levels of dissolved oxgyen in the water column and create an unpleasant odor. This effect would be both spatially and temporally limited and, with the influx of tidally circulated waters, be of little consequence.

The potential for release of sediment contaminants during the dredging process can be evaluated by using the standard elutriate test. The elutriate test approximates the theoretical maximum attainable level of contaminant release during resuspension of sediments. The test is defined in the Environmental Protection Agency and Corps of Engineers document entitled: "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters" (1977). The elutriate test mixes one part sediment with four parts seawater (from Rye Harbor) and vigorously agitates the slurry for thirty minutes. After settling for one hour the filtered elutriate is analyzed for sediment release of contaminants. The concentration of contaminants in the supernate is quantified; therefore, these values represent maximum possible elution.

The elutriate tests exhibit potential releases above ambient water concentrations of nitrates (Stations B, C, D, and E), total phosphorus (all stations) lead (Station C), arsenic (Stations C, D, and F), cadmium

(Stations B and D), chromium (Stations B, C, D, and F), copper (Stations B, C, D, and F), nickel (Stations C, D, E, and F), and vanadium (Stations B, C, D, and F).

These "releases" represent the maximum concentrations of free (non-adsorbed) chemicals. All of the potential concentrations to be released are well below the Environmental Protection Agency's water quality criteria (See Appendix I), except for total phosphorous and PCB concentrations which exceeded the criteria. The tidal flushing of Rye Harbor should adequately distribute the released phosphorous throughout the harbor. This release of phosphorous will not eutrophicate the harbor because of this tidal mixing. Using the elutriate testing, it is evident that significant chemical contaminants will not be released at the point of dredging. PCB values do indicate a potential for release during dredging, but this potential is greater from the disposal plume, as discussed below. The tidal mixing in the harbor will quickly dilute PCB levels to ambient concentrations.

c. Biological Effects

The dredging of 85,000 cubic yards of substrate from the Rye Harbor channel and anchorage areas destroys benthic habitat and associated organisms by physical removal. Recent investigations (Van Dolah et. al, 1984) have shown these effects short lived in other estuaries (3 months in South Carolina). The loss of productivity from these habitats is short term since faunal recolonization will occur. Pioneering organisms will dominate the disturbed habitat and biogenically (benthic invertebrate metabolic activity) rework the substrate. After a few seasons, seral (a series of pioneering benthic invertebrate communities) successions will occur and increasing numbers of species will inhabit the area until pre-dredging benthic community structure will be obtained. This benthic community was described by Cortell (1977) as being dominated by the polychaetes *Cirratulus* sp. and *Clymenella torquata*.

During the recolonization period, there will be a large number of individuals from a few benthic species probably spionids, *Mytilus edulis* and *Nephtys incisa* (Pearson and Rosenberg, 1978). Subsequent populations will recruit a greater number of species having fewer individuals. Concurrent with this transitional stage, the substrate will be reworked until it becomes properly aerated and suitable for colonization by more species. It is the large numbers of pioneering benthic species that rework the substrate in a short time frame. These organisms are also an important source of forage for juvenile finfish. The dredging of the channel will cause a short term loss of benthic productivity that will be restored through faunal recolonization.

Photosynthetic processes and associated productivity will be decreased during periods of high turbidity. This reduction in primary production will be temporary. Sediment suspension will also displace motile species avoiding gill abrasion, lower oxygen levels and reduced sensory opportunities for predation (masked odors and low visibility) in the dredging area. These would all be temporary and insignificant effects.

2. Disposal Site

New England Division has determined that the dredged material meets the testing exemption criteria of Section 227.13(b)(3)(ii) of the Ocean Dumping Act and is suitable for disposal at the Cape Arundel site. This determination is based on the low contaminant concentrations in the bulk chemical testing results.

a. Physical and Chemical Effects

Dredged material from Rye Harbor, New Hampshire will be placed on a disposal barge and towed to the Cape Arundel Disposal Site, approximately 25 nautical miles northeast of the project area. Each barge can transport about 1500 cubic yards per trip. The material will be released through doors on the bottom into the water column for deposition. Most of the material released from the scow would be transported to the bottom through convective descent. Only a small amount (1-5%) of the sediment would remain suspended following disposal.

Sampling of CADS (SAIC, 1986) was undertaken to address disposal site management questions. A prime objective of the characterization tests was to determine whether or not the site is a low energy environment capable of containing the dredged material. Test results indicate that tidal currents are not strong enough at the site to resuspend sediments. Occassional intense northeasterly storm events could move the sediments. However, it is expected to have a minimal impact and be undetectable beyond the margins of the site. Therefore, dredged material is expected to remain stable within the site over the long term.

Elutriate test results are used to determine the potential amount of contaminant release into the water system from dredged material. Water for the elutriate tests was obtained from Rye Harbor. Due to the large volume of water at the disposal site and minor releases identified in the elutriate tests (Appendix I), the dredged material is not expected to significantly impact water quality at the disposal site.

b. Biological Effects.

The disposal of dredged sediments would bury any benthic organisms at the point of disposal. Burying of more sensitive eggs, larvae and juvenile forms would probably result in death. Larger mobile forms such as fish would have a better chance of survival. Although some species may lose their traditional forage site, the area represents a small percentage of similar habitats available throughout the Gulf of Maine. Those organisms killed or injured in the discharged sediments would serve as prey for scavenging crustaceans, gastropods and fish in the vicinity of the disposal site.

The current assemblage of benthic species in the disposal area, where dredged material has been deposited in the past, are indicative of a pioneering community. Environmental studies conducted (SAIC, 1986) at CADS denoted differences in species composition and densities between stations containing dredged material and non-dredged material. At the dredged material stations, higher densities of near-surface dwelling organisms (oligochaetes) and low densities of head down, deposit feeders, (e.g. maldanids) were recorded. These deposit-feeders are dominant in unaltered stations. The unaltered stations also support a greater species richness and abundance.

Disposal of material at the unaltered station would likely reduce species richness to that identified in the present disposal station at CADS (SAIC, 1986). Disposal at the current discharge area will temporarily affect species composition. Recolonization of the dredged area would occur shortly after disposal activities ceased. It is anticipated that recolonization by similar species from nearby areas would occur. These species will reproduce in the spring and summer, recolonizing the disposal area. Gradually successive benthic associations would give way to a climax community of longer-lived species. This climax community will occur if no additional disposal operations occur within the next few years.

Chemical analysis of the material to be disposed, and the elutriate testing of this material, identified little potential for chemical impacts. The only elevated level of all testing (see Affected Environment) was the potential elution of high phosphorus concentrations and PCB. In a closed ecosystem, phosphorus inputs could cause eutrophication. In a tidally driven ocean system, such as CADS tidal circulation would dissipate the impacts of phosphorus to the ecosystem.

Polychlorinated Biphenyl Compounds

Appendix I lists the bulk sediment chemistry and elutriate analyses for sediments in Rye Harbor. The only toxic substance in elevated concentrations is the organic compound PCB. This substance is not found in high concentrations (maximum 610 ppb at station F), but is potentially easily elutriated. The presence of PCB in these concentrations is normally associated with urban estuarine systems. The elevated concentrations of PCB in Rye Harbor (above the 0.03 ppb EPA water quality criteria) represents an enigma given the undeveloped nature of the watershed. PCB has commonly been found in hydraulic fluids and electrical transformers. Accidental spills from either of these sources could explain the chemical's presence in the harbor.

Station A (entrance channel) did not contain sufficient fine grained material to analyze (see Figure 1).

Station B (North anchorage) contained 80 ppb PCB in the 1985 sediment bulk chemical analysis and an ambient water concentration of 0.17 ppb. Elutriate analysis (two replicates) revealed a value of 0.052 ppb.

The 1985 sediment analysis at Station C (eastern edge of the south anchorage) contained 320 ppb bulk chemistry, an ambient concentration of 0.19 ppb and two elutriate replicates of 0.18 and 4.8 ppb. Additional analyses were performed in 1986 on this station and Station F in an attempt to explain the highly variable replicates and the distribution of PCB vertically through a sediment (strata) depth profile. At Station C the 1986 ambient water was 0.04 ppb (still above the EPA 0.03 ppb criteria) and only the top 10 cm contained PCB in the elutriate test (0.04, 0.04 and <0.02 ppb). The 10-20 cm depth did not elutriate PCB in any replicates (<0.02 for all three analyses). The 0.04 ppb concentrations for the upper 10 cm can be assumed to correlate (equilibrium) with the ambient water 0.04 ppb concentration. The elutriate procedure mixed the Station C sediment with Station C ambient water and the supernate contained 0.04 ppb of PCB.

In 1985 sampling Station D (center channel) bulk analysis contained 120 ppb PCB while elutriate testing recorded ambient concentrations of 0.71 ppb in the ambient water and two test replicates of 0.20 and 0.43 ppb. This decrease in PCB level in the supernate can be a function of the adsorptive capacity of the fine grained material, i.e. adsorption of the PCB molecules to the sedimets that settle out from the supernate.

Bulk analysis of a 1985 sample at Station E (western edge of the south anchorage) contained 400 ppb of PCBs. The elutriate results were obtained using ambient water concentrations of 0.35 ppb and were 0.52 ppb and 0.25 ppb for two replicates.

Station F was located in the most nearshore (western) portion of the federal channel, and contained the highest silty/clay content (85% fine grained material). This station also exhibited the highest bulk sediment concentrations of PCBs; 610 ppb. The elutriate testing revealed an ambient water PCB concentration of 0.22 while three replicates (0.49, 0.13, 0.42) averaged 0.347 ppb (S.D. = 0.191) with a 55.0% relative standard deviation.

Given the variability of the above results, absence of field "blanks" for quality assurance, and the lack of statistically significant replication for most analyses, a new series of elutriate tests were analyzed in June of 1986 at Stations F and C for "regular" elutriate testing. Additionally, the "worst case" (Station F) scenario was depicted by performing a modified elutriate test that simulates the disposal site weir discharge for the previously proposed upland site. The Modified Elutriate Test is explained in detail in the U.S. Army Corps of Engineers publication D-86-1: "Interim Guidance for Predicting the Quality of Effluent Discharged from Confined Dredged Material Disposal Areas" (Palermo, 1986). This procedure estimates both the dissolved and particulate associated concentrations of contaminants in the confined disposal sites effluent.

The results of the "Regular" elutriate test and the "Modified" elutriate test both confirmed the existance of ambient PCB concentations in Rye Harbor exceeding the EPA water quality criteria. All field blanks were clean (<0.02 ppb) and each of three single site analyses of ambient concentrations (Station C, F and modified F) revealed a 0.04 ppb concentration. Since the 0.03 ppb PCB criteria is already exceeded in the harbor the least environmentally damaging option for the Rye Harbor ecosystem is to remove the PCB source from the harbor.

To determine the depth of PCB contamination in the substrate (strata) regular elutriate testing was performed on two separate horizons (0-10 cm and 12 to 23 cm) from stations C and F (see Appendix I).

Station C had an upper horizon elution concentration of 0.04 ppb, 0.04 ppb and <0.02 ppb for three replicates. The lower (12 to 23 cm) horizon elution contained <0.02 ppb PCB for all three replicates. The ambient water concentration was 0.04 ppb and the blank quality assurance test was also below the 0.02 ppb detection limit.

Station F has an upper horizon elution concentration (0.08, 0.04 and 0.39 ppb) averaging 0.17 ppb with a relative standard deviation of 113%. The variability in this data is assumed a sampling or analysis artifact. The lower horizon contained 0.04 and 0.02 ppb PCB for the two replicates performed. The field QA blank was below the 0.02 ppb detection limit and the ambient water concentration was determined as 0.04 ppb PCB.

The modified elutriate test contained the most reasonable results, albeit elevated when compared to the previous test at the same site. Triplicate replication (0.26, 0.26 and 0.18 ppb) averaged 0.233 ppb PCB with a 19.7% relative standard deviation. The ambient water concentration was 0.04 ppb and the QA field blank was below the 0.02 ppb detection limit. These results were also the average value incorporated into the calculation of the disposal effluent (Palermo, 1986), and the 0.04 ppb ambient concentration is assumed valid.

The predicted effluent concentration for discharge resulting from dredging the highest PCB contaminated area (Station F) was calculated using a technique developed by the U.S. Army Corps of Engineers and EPA (1977) in their joint handbook entitled "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters." The calculation is an overestimation of the project impacts since only a small portion (in the vicinity of Station F) of the project involves dredging and disposal of sediments of a 610 ppb PCB concentration. These sediments will be dredged and subsequently covered within the disposal site, with sediments containing lower PCB concentrations.

The disposal site discharge will intermix with the 300,000m^3 available mixing zone of water at CADS. Calculation of the dilution factor (D=6.8) necessary to effectively minimize alterations in ambient concentrations revealed that within 99.9% of the available mixing zone ($14,293.6\ m^3$) the ambient concentration of PCB resulting from disposal will be diluted to below the EPA Quality criteria for water.

The fine grained materials that have accumulated in the channel and anchorages since the creation of the federal project are a function of the estuarine nature of the harbor. The freshwater inflow transports silts from the watershed that precipate and settle upon encountering saline and tidal conditions. These fine grained materials act as an adsorptive sink for the PCB molecules and are easily resuspended by storm wave and tidal currents. Chemical elutriation from this resuspension is ultimately the causative factor for the 0.04 ppb levels of PCB in the harbor given the absence of a known chronic source. Removal of these sediments and disposal at CADS will represent a lessening of the chronic PCB input to the Rye Harbor environment.

3. Threatened and Endangered Species

There are no Federally listed threatened or endangered species known to inhabit the dredging or disposal site. If any transient endangered species entered either area during the project operation, they would avoid the activity. Since all impacts on the environment are temporally and spatially limited, impacts on the food sources or habitat of these species are also assumed minimal.

4) Ecologically Significant Species

The ecologically significant species (see E. Affected Environment) found in the harbor include the clam _Mya arenaria_, the lobster _Homarus americanus_ and the smelt _Osmarus mordax_ (Cortell, 1977). These species are highly adaptable estuarine organisms. The impacts on water quality and habitat alteration will not significantly impact the populations of these species in Rye Harbor since the dredging will be spatially and temporally limited, and scheduled to minimize conflict with anadromous fisheries resources.

The disposal site at Cape Arundel has been used since 1983 and no significant adverse impacts have been identified to date.

5) Historic and Archaeological Resources

The maintenance dredging of the Rye Harbor Federal navigation channel and anchorages will be confined to within the limits of the existing channel and anchorages. The dredged material will be disposed at an ocean disposal site that has previously been used. It has been determined by the Archaeologist of the New England Division, U.S. Army Corps of Engineers that no historic or archaeological resources will be impacted by this project.

6) Social and Economic Resources

The maintenance dredging has a projected function of establishing the 8 and 10 foot channels and the 6 and 8 foot anchorages. These areas service four charter fishing vessels called "head boats", that carry approximately 30,000 passengers per year. The channel provides access to the State Pier by the head boats and 8 full-time finfish boats (trawlers and gill netters) operating out of Rye. These commercial boats offload approximately 2 million pounds of fish per year. There are 20 full-time lobster boats landing approximately 150,000 pounds of lobster annually. These commercial vessels and approximately 108 recreational boats are moored in the anchorage areas.

The economy of Rye Harbor is based on the accessability of the charter and fishing vessels to the State Pier for loading and offloading. The recreational boating contributes to the economy of local restaurants and support facilities. These industries resources will receive direct economic benefit from the project.

G. Procedures to Minimize Impacts

The dredging activity will occur between 1 September through 15 May. This will avoid the summer spawning of shellfish (*Mytilus edulis* and *Mya arenaria*) in June through August and the late spring (May-June) return of anadromous fish (*Osmerus mardax* to the estuary (NMFS, 1980). Additionally, the mid-May through summer lobster (*Homarus americanus*) molt will be avoided.

Proper disposal site management will serve to minimize adverse impacts on water quality. Monitoring of discharge for position and restriction of discharge to vicinity of the buoy will serve to minimize spatial impacts. The dredge will, when practical, begin at the mouth of the harbor, proceed through the channel and 6-foot anchorage then dredge the more contaminated area near the State pier. Finally the remaining (8 foot) anchorage will be dredged. This will allow disposal activity to mix and layer the more chemically elevated material with the anchorage material.

H. Coordination

A public notice has been issued. The proposed project has been coordinated with the following Federal and State agencies.

Federal Agencies
Environmental Protection Agency
National Marine Fisheries Service
U.S. Fish and Wildlife Service

State of New Hampshire
Department of Resources & Economic Development
State Wetlands Board
State Planning Office
State Historical Preservation Officer

State of Maine
Department of Environmental Protection

I. Compliance

The compliance status of this project with Environmental Protection Statues and Executive Orders is as follows:

STATUTES

1. Archaeological and Historic Preservation Act, as amended, 16 U.S.C. 469 *et* seq.

STATUS: It has been determined that the project area does not contain any archaeological, cultural or historic resources that would be impacted.

2. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

STATUS: Public Notice of the availability of this report to the Regional Administrator of the Environmental Protection Agency constitutes compliance with this Act.

3. Clean Water Act (Federal Water Pollution Control Act), as amended, 33 U.S.C. 1251 *et seq*.

STATUS: A water quality certification will be obtained for the disposal discharge.

4. Coastal Zone Management Act of 1972, as amended 16. U.S.C. 1451 *et seq*.

STATUS: This project will be reviewed under the applicable Maine and New Hampshire State Coastal Zone Management Programs as a result of the

Coastal Zone Management Act of 1972.

5. Endangered Species Act of 1973, as amended, 16 U.S.C. 1a531 et seq.

STATUS: Coordination with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the proposed project is ongoing.

6. Estuary Protection Act, 16 U.S.C. 1221 et seq.

STATUS: Public Notice of the availability of the assessment to the Department of the Interior constitutes compliance with this act.

7. Federal Water Project Recreation Act, as amended, 16 U.S.C. 661 et seq.

STATUS: Public Notice of the availability of this assessment to the Department of the Interior constitutes compliance with this Act.

8. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

STATUS: Coordination with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service constitutes compliance with this act.

9. Land and Water Conservation Funds Act of 1965, as amended, 16 U.S.C. 470-4 et seq.

STATUS: Submission of the assessment to the Department of the Interior constitutes compliance with this act.

10. Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 et seq.

STATUS: This ocean water disposal at CADS has been subject to review by this act. New England Division has determined that the dredged material is suitable for ocean disposal.

11. National Historic Preservation Act of 1966, as amended 16 U.S.C. 470 et seq.

STATUS: Coordination with the New Hampshire State Historic Preservation Officer constituted compliance with this act. There were no archaeological, cultural or historic resources identified as being impacted by this project.

12. National Environmental Policy Act of 1969, as amended, 42 U.S.C. 432 et seq.

STATUS: Preparation of this Environmental Assessment constitutes compliance with this Act.

13. Watershed Protection and Flood Prevention Act, as amended, 16 U.S.C. 1001 *et seq*.

STATUS: This project does not adversely impact or contribute to flooding of any watershed.

14. Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 *et seq*.

STATUS: This project does not involve any wild or scenic rivers.

Executive Orders

1. Executive Order 11988, Floodplain Management, 24 May 1977.

STATUS: In accordance with this Executive Order the proposed project would not contribute to negative impacts or damages caused by floods.

2. Executive Order 11990, Protection of Wetlands, 24 May 1977.

STATUS: This Executive Order is not applicable. There will be no impacts on wetlands by this project.

3. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

STATUS: This Executive Order is not applicable to this project.

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Appendix I

Physical and Chemical Sediment Analyses

Results of tests performed on: (1) the standard elutriate prepared from one part sediment taken at various sampling locations with four parts water from each sampling location and (2) the water from each sampling location are as follows:

	Dredge Site Water B	Standard Elutriate Designation and Sediment Depth Used in Preparation B Surface R1	R2	R3	Dredge Site Water C	Standard Elutriate Designation and Sediment Depth Used in Preparation C Surface R1	R2	R3
Nitrate/Nitrite Nitrogen(N), ppm	<0.02	0.06	0.06	0.10	<0.02	0.07	0.05	0.003
Sulfate (SO_4), ppm	2550	2332	2369	2393	2541	2081	1958	1958
Phosphorus								
ortho, ppm	0.02	<0.01	<0.01	<0.01	0.02	1.21	1.28	1.10
total, ppm	0.08	0.08	0.12	0.09	0.10	1.39	1.43	1.39
Mercury (Hg), ppb	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead (Pb), ppb	1.6	1.3	1.3	1.2	1.4	1.4	1.2	1.7
Zinc (Zn), ppb	<25	<25	<25	<25	<25	<25	<25	<25
Arsenic (As), ppb	3.8	<1.7	<1.7	<1.7	6.0	23.7	25.0	28
Cadmium (Cd), ppb	0.7	1.5	1.5	0.6	1.5	1.1	0.5	0.6
Chromium (Cr), ppb	<1.5	1.5	1.7	<0.5	1.5	2.3	2.1	2.8
Copper (Cu), ppb	2.7	5.6	3.3	5.2	1.2	1.2	1.4	3.2
Nickel (Ni), ppb	6.3	1.7	<1.7	<1.7	1.9	4.2	7.7	9.9
Vanadium (V), ppb	<3	15	9	<3	<3	<3	22	5
Total PCB, ppb	0.17	0.12	0.052		0.19		0.18	4.8
Total DDT, ppb	<0.01	<0.01	<0.01		<0.01		<0.01	<0.01

ELUTRIATE TESTING-Rye, NH

Results of tests performed on: (1) the standard elutriate prepared from one part sediment taken at various sampling locations with four parts water from each sampling location and (2) the water from each sampling location are as follows:

	Dredge Site Water	Standard Elutriate Designation and Sediment Depth Used in Preparation			Dredge Site Water	Standard Elutriate Designation and Sediment Depth Used in Preparation		
	D	D Surface			E	E Surface		
		R1	R2	R3		R1	R2	R3
Nitrate/Nitrite Nitrogen(N), ppm	0.02	<0.01	0.06	0.06	0.01	0.07	0.05	0.13
Sulfate (SO_4), ppm	2541	2402	2346	2393	2527	2430	2485	2578
Phosphorus								
ortho, ppm	0.02	0.12	0.61	1.18	0.02	0.03	0.01	0.01
total, ppm	0.10	0.23	0.68	0.95	0.09	0.08	0.11	0.11
Mercury (Hg), ppb	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead (Pb), ppb	1.4	1.0	1.2	<0.8	1.9	1.2	<0.8	1.4
Zinc (Zn), ppb	< 25	<25	<25	<25	< 25	<25	<25	<25
Arsenic (As), ppb	5.4	5.0	20.0	28.0	4.9	4.1	3.0	3.2
Cadmium (Cd), ppb	0.4	<0.4	0.5	0.8	0.7	0.6	0.6	0.5
Chromium (Cr), ppb	<1.5	1.6	2.1	<1.5	<1.5	-	<1.5	<1.5
Copper (Cu), ppb	5.0	1.6	5.7	10.1	5.0	1.0	2.3	<1
Nickel (Ni), ppb	6.3	<1.7	1.8	14.3	1.9	3.9	8.9	6.3
Vanadium (V), ppb	29	10	11	46	<3	8	<3	<3
Total PCB, ppb	0.71	0.20	0.43		0.35	0.52	0.25	
Total DDT, ppb	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	

ELUTRIATE TESTING-Rye, NH

Results of tests performed on: (1) the standard elutriate prepared from one part sediment taken at various sampling locations with four parts water from each sampling location and (2) the water from each sampling location are as follows:

	Dredge Site Water	Standard Elutriate Designation and Sediment Depth Used in Preparation			Water Quality Criteria
	F	F Surface			
		R1	R2	R3	
Nitrate/Nitrite Nitrogen(N), ppm	0.22	0.22	0.02	0.02	10
Sulfate (SO_4), ppm	2513	2177	2187	2046	-
Oil and grease, ppm					
Phosphorus					-
ortho, ppm	0.02	1.28	1.44	1.67	0.1
total, ppm	0.10	1.47	1.68	1.88	0.1
Mercury (Hg), ppb	<0.5	<0.5	<0.5	<0.5	3.7
Lead (Pb), ppb	1.3	<0.8	<0.8	1.4	25
Zinc (Zn), ppb	<25	<25	<25	<25	170
Arsenic (As), ppb	<1.7	30.9	32.5	28.1	508(acute)
Cadmium (Cd), ppb	0.9	<0.4	<0.4	0.6	59
Chromium (Cr), ppb	<1.5	3.3	<1.5	5.0	1260
Copper (Cu), ppb	2.1	7.0	3.4	2.8	23
Nickel (Ni), ppb	<1.7	9.3	8.5	8.8	140
Vanadium (V), ppb	<3	<3	<3	<3	-
Total PCB, ppb	0.22	0.49	0.13	0.42	0.03
Total DDT, ppb	<0.01	<0.01	<0.01	<0.01	0.10

BOTTOM SEDIMENT SAMPLE TEST RESULTS

RCS NEDED-6 (FEEDER)

PROJECT NO. (CC 1-7)	PROJECT TITLE (CC 13-52)	YEAR (CC 53-56)	STATE (CC 57-61)	TIDAL SYS (CC 62-66)	COM/REC (CC 67-69)
DCHA48	Rye Harbor	1985	N.H.	MT	C/R

	CC	01	02	03	04	05	CC
DC SERIAL NO.	01						01
EXPLORATION NO	02	A	B	C	D	E	02
SAMPLE NO.	03	1	1	1			03
SAMPLE DEPTH (FT)	04	Surface	Surface	Surface	Surface	Surface	04
LATITUDE	05						05
LONGITUDE	06					163,770	06
GRID LOC-NORTH	07	183,320	183,910	183,520	183,810	~~[illegible]~~	07
GRID LOC-EAST	08	746,270	745,900	745,930	745,630	~~[illegible]~~ 745,310	08
SOUNDING	11	7.0	7.0	12.0	13.5	7.0	11
REDUCED SOUNDING-MLW	12	6.5	5.5	7.0	7.0	3.0	12
DATE - HOUR	13	5087-1150	5087-1230	5087-1400	5087-1530	5088-1330	13
WEATHER	14	0	0	0	0	0	14
SEA STATE	15	0	0	0	0	0	15
SECCHI DISC-BLACK	16						16
SECCHI DISC-WHITE	17						17
VISUAL CLASSIFICATION BY LABORATORY	20	Dark gray	Black	Black	Black	Black	20
	21	Fine Sand	Organic	Organic	Organic	Organic	21
	22	(SP)	Silty	Sandy	Sandy	Sandy	22
	23	W trace	Fine Sand	Silt (OH)	Silt (OL)	Silt	23
	24	Of Silt	(SM)			(OH)	24
	25						25
	26						26
	27						27
	28						28
	29						29
SOIL CLASS/DOMIN	32	SP	SM	OH	OL	OH	32
SOIL CLASS/SUB-DOMIN	33	0.1500	0.0850	0.0650	0.0280	0.0500	33
GRAIN SIZE CURVE-MED	34	0.1700	0.1500	0.0800	0.0750	0.0800	34
GRAIN SIZE CURVE-Q1	35	0.1300	0.0450	0.0400	0.0250	0.0150	35
GRAIN SIZE CURVE-Q3	36						36
GR SIZE CURVE-% FINE	38	3	47	72	75	75	38
NORMAL/BIMODAL	39	N	N	N	N	B	39
LIQUID LIMIT	40	NP	51	60	46	±92	40
PLASTIC LIMIT	41	NP	35	41	43	48	41
PLASTIC INDEX	42	NP	17	19	3	44	42
SPEC GRAV SOLIDS	47	2.69	2.65	2.59	2.66	2.58	47
WET UNIT WGT (PCF)	48						48
DRY UNIT WGT (PCF)	49						49
PERCENT SOLIDS	50		51.0	63.6	47.3	38.5	50
SEDIMENT PH	51		7.0	6.8	7.0	6.8	51
RED ROX POT (MV)	52						52
% VOL SOLIDS- EPA	57		7.63	4.47	9.29	11.12	57
% VOL SOLIDS- NED	58		5.70	2.94	5.52	8.21	58
% TOT VOL SOL-EPA	59						59
PPM CHEM OXYGEN DMND	60		25,400	56,100	70,500	102,100	60
PPM TOT KJDL NIT	61						61
PPM OIL & GREASE	62		83	364	204	290	62
PPM MERCURY	63		0.12	0.08	0.19	0.07	63
PPM LEAD	64		LT 26	LT 27	LT 27	LT 27	64
PPM ZINC	65		76	60	62	41	65
PPM ARSENIC	70		4.9	LT 0.5	3.9	3.7	70
PPM BISMUTH	71						71
PPM CADMIUM	72		LT 3	4	LT 3	LT 3	72
PPM CHROMIUM	73		LT 15	30	16	22	73
PPM COPPER	74		LT 6	LT 7	LT 7	LT 7	74
PPM IODINE	75						75
PPM NICKEL	76		LT 39	LT 41	LT 40	LT 40	76

		A		B		C		D		E	
IL CLASS/DOMIN	32	SP		SH		OH		OL		OH	32
IL CLASS/SUB-DOMIN	33	0.1500		0.0850		0.0650		0.0280		0.0500	33
AIN SIZE CURVE-MED	34	0.1700		0.1500		0.0800		0.0750		0.0800	34
AIN SIZE CURVE-D1	35	0.1300		0.0450		0.0400		0.0250		0.0150	35
AIN SIZE CURVE-D3	36										36
SIZE CURVE-% FINE	38	3		47		72		75		75	38
RMAL/BIMODAL	39	N		N		N		N		B	39
QUID LIMIT	40	NP		51		60		46		92	40
ASTIC LIMIT	41	NP		35		41		43		48	41
ASTIC INDEX	42	NP		17		19		3		44	42
EC GRAV SOLIDS	47	2.69		2.65		2.59		2.60		2.58	47
T UNIT WGT (PCF)	48										48
Y UNIT WGT (PCF)	49										49
RCENT SOLIDS	50			51.0		63.6		47.3		38.5	50
DIMENT PH	51			7.0		6.8		7.0		6.8	51
D RDX POT (MV)	52										52
VOL SOLIDS- EPA	57			7.63		4.47		9.29		11.12	57
VOL SOLIDS- NED	58			5.70		2.94		5.52		8.21	58
TOT VOL SOL-EPA	59										59
PM CHEM OXYGEN DMND	60			25,400		56,100		70,500		102,100	60
PM TOT KJDL NIT	61										61
PM OIL & GREASE	62			83		364		204		290	62
PM MERCURY	63			0.12		0.08		0.19		0.07	63
PM LEAD	64		LT	26	LT	27	LT	27	LT	27	64
PM ZINC	65			76		60		62		41	65
PM ARSENIC	70			4.9	LT	0.5		3.9		3.7	70
PM BISMUTH	71										71
PM CADMIUM	72		LT	3		4	LT	3	LT	3	72
PM CHROMIUM	73		LT	15		30		16		22	73
PM COPPER	74		LT	6	LT	7	LT	7	LT	7	74
PM IODINE	75										75
PM NICKEL	76		LT	39	LT	41	LT	40	LT	40	76
PM PHOSPHORUS	77										77
PM SILVER	78										78
PM TIN	79										79
PM VANADIUM	80		LT	91	LT	99	LT	97	LT	97	80
CARBON (ORGANIC)	85										85
CARBON (CARBONATE)	86										86
CARBON (TOTAL)	87			1.77		3.42		4.23		4.66	87
HYDROGEN	88			0.31		1.32		0.59		[illegible]	88
NITROGEN	89			0.29		0.34		[illegible]		[illegible]	89
PM BENZENE	90										90
PB DDT	91		LT	1	LT	1	LT	1	LT	1	91
PB PLYCHL BIPH	92			80		320		120		400	92
FREON 14 (YPS)	93										93
DIOACTIVITY(MR/HR)	94										94

REMARKS

R1 ____
R2 ____
R3 ____
R4 ____

*- LEGEND:
LI- LIMIT OF INSTRMT
NP- NON-PLASTIC
LT- LESS THAN
GT- GREATER THAN

BOTTOM SEDIMENT SAMPLE TEST RESULTS (FEB/PP)

PROJECT NO. (CC 1-7)	PROJECT TITLE (CC 13-52)	YEAR (CC 53-56)	STATE (CC 57-61)	TIDAL SYS (CC 62-66)	SAMPLER (CC 67-69)
??.HA48	Rye Harbor	1985	N.H.	MT	C/N

	ITEM	*	06	*	07	*	08	*	09	*	10	
S SERIAL NO.	01											01
LOCATION NO.	02		F									02
MPLE NO.	03		1									03
MPLE DEPTH (FT)	04		Surface									04
ATITUDE	05											05
ONGITUDE	06											06
C-ORD LOC-NORTH	07		184,180									07
C-ORD LOC-EAST	08		744,800									08
OUNDING	11		7.0									11
EDUCED SOUNDING-MLW	12		3.0									12
ATE - HOUR	13		5088-1330									13
EATHER	14		0									14
EA STATE	15		0									15
ECCHI DISC-BLACK	16											16
ECCHI DISC-WHITE	17											17
VISUAL CLASSIFICATION BY LABORATORY	20		Black									20
	21		Organic									21
	22		Sandy									22
	23		Silt (OH)									23
	24											24
	25											25
	26											26
	27											27
	28											28
	29											29
OIL CLASS/DOMIN	32		OH									32
OIL CLASS/SUB-DOMIN	33											33
RAIN SIZE CURVE-MED	34		0.0150									34
RAIN SIZE CURVE-Q1	35		0.0250									35
RAIN SIZE CURVE-Q3	36		0.0120									36
R SIZE CURVE-% FINE	38		85									38
ORMAL/BIMODAL	39		N									39
IQUID LIMIT	40		130									40
LASTIC LIMIT	41		54									41
LASTIC INDEX	42		76									42
PEC GRAV SOLIDS	47		2.55									47
ET UNIT WGT (PCF)	48											48
RY UNIT WGT (PCF)	49											49
ERCENT SOLIDS	50		30.8									50
EDIMENT PH	51		6.4									51
ED REDOX POT (MV)	52											52
VOL SOLIDS- EPA	57		15.05									57
VOL SOLIDS- NED	58		11.44									58
TOT VOL SOL-EPA	59											59
PM CHEM OXYGEN DMND	60		133,000									60
PM TOT KJD NIT	61											61
PM OIL & GREASE	62		698									62
PM MERCURY	63	LT	0.04									63
PM LEAD	64	LT	27									64
PM ZINC	65		95									65
PM ARSENIC	70		9.7									70
PM BISMUTH	71											71
PM CADMIUM	72	LT	3									72
PM CHROMIUM	73		66									73
PM COPPER	74		7									74
PM IODINE	75											75
PM NICKEL	76	LT	41									76
PM PHOSPHORUS	77											77
PM SILVER	78											78
PM TIN	79											79
PM VANADIUM	80	LT	99									80

F

SOIL CLASS/DOMIN	32		OH									
SOIL CLASS/SUB-DOMIN	33											
GRAIN SIZE CURVE-MED	34		0.0150									
GRAIN SIZE CURVE-Q1	35		0.0250									
GRAIN SIZE CURVE-Q3	36		0.0120									
GR SIZE CURVE-% FINE	38		85									3
NORMAL/BIMODAL	39		N									3
LIQUID LIMIT	40		130									4
PLASTIC LIMIT	41		54									4
PLASTIC INDEX	42		76									4
SPEC GRAV SOLIDS	47		2.55									4
WET UNIT WGT (PCF)	48											4
DRY UNIT WGT (PCF)	49											4
PERCENT SOLIDS	50		30.8									5
SEDIMENT PH	51		6.4									5
SED RDX POT (MV)	52											5
% VOL SOLIDS- EPA	57		15.05									5
% VOL SOLIDS- NED	58		11.44									5
% TOT VOL SOL-EPA	59											5
PPM CHEM OXYGEN DMND	60		133,000									6
PPM TOT KJD NIT	61											6
PPM OIL & GREASE	62		698									6
PPM MERCURY	63	LT	0.04									6
PPM LEAD	64	LT	27									64
PPM ZINC	65		95									65
PPM ARSENIC	70		9.7									70
PPM BISMUTH	71											71
PPM CADMIUM	72	LT	3									72
PPM CHROMIUM	73		66									73
PPM COPPER	74		7									74
PPM IODINE	75											75
PPM NICKEL	76	LT	41									76
PPM PHOSPHORUS	77											77
PPM SILVER	78											78
PPM TIN	79											79
PPM VANADIUM	80	LT	99									80
% CARBON (ORGANIC)	85											85
% CARBON (CARBONATE)	86											86
% CARBON (TOTAL)	87		7.72									87
% HYDROGEN	88		1.22									88
% NITROGEN	89		1.07									89
PPM BENZENE	90											90
PPB DDT	91	LT	1									91
PPB POLYCHL BIPH	92		610									92
CARBON 14 (YRS)	93											93
RADIOACTIVITY(MR/HR)	94											94

REMARKS

R1 __________
R2 __________
R3 __________
R4 __________

*- LEGEND.
LI- LIMIT OF INSTRM
NP- NON-PLASTIC
LT- LESS THAN
GT- GREATER THAN

ED FORM MAR 77 691

Comparison Chart, Rye Harbor, 1985

Substance	1974 GE-3 surface	1985 "C" surface	1974 GE-4 surface	1985 "B" surface	1974 PE-5 0.0-0.25 ft	1985 "D" surface	1974 PE-7 0.0-0.25 ft	1985 "F" surface
COD, ppm	67,100	56,100	82,900	25,400	90,800	70,500	71,900	133,000
PB, PPM	50	<27	55	26	30	<27	70	<27
ZN, PPM	57	60	51	76	68	62	66	95
CR, PPM	50	30	55	<15	60	16	58	66
CU, PPM	42	<7	55	<6	60	<7	41	7
C:N	21.8	8.8	14.5	9.3	---	8.1	---	7.2
% FINES	14	72	15	47	61	75	56	85
% COARSE MATERIAL (pass <#10 s)	60	<1	65	<1	<1	<1	<1	<
% MEDIUM SAND (pass #10 s retain #40 s	5	5	7	2	1	3	1	5
% FINE SAND (pass #40 s retain #200 s)	21	23	13	51	38	22	43	10
CLASSIFICATION	gravel	silt	gravel	sand	silt	silt	silt	silt

Appendix II
Biological Report

BR-IAB-85-1

BIOLOGICAL REPORT

for the Proposed Maintenance
Dredging Project in

RYE HARBOR, NEW HAMPSHIRE

26 AUGUST 1985

William A. Hubbard
Marine Ecologist

Impact Analysis Branch
New England Division
U.S. Army Corps of Engineers
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INTRODUCTION

On 26 August 1985, Mr. William Hubbard and Mr. Mark Otis assessed the intertidal resources of Rye Harbor, New Hampshire. The purpose of this sampling effort was to describe the affected environment for a proposed maintenance dredging project of the Federal channel (see Figure 1). In addition to the intertidal sampling, the previously proposed upland disposal site was qualatatively described.

MATERIALS AND METHODS

Four sampling transects were established through the intertidal zones of Rye Harbor. Transect I has three stations sampled and Transects II, III, and IV each had two stations sampled. The stations were established along the sampling transect at the mid-tide level (Station #1) and low-tide level (Station #2), except for Transect I that has two mid-tide stations (Station #1 and 2) and one low tide station (Station #3).

Rye Harbor is located approximately five miles south of Portsmouth Harbor (43'03.8", 70' 42.3") with a mean tidal range of 2.7 meters (8.7 feet) flooding a maximum of 61.7 cm/sec (1.2 knots) northerly 355^{o} and ebbing a maximum of 92.6 cm/sec (1.8 knots) at 195^{o} west by north. On the day of sampling weather conditions were cool (15.6^{o}C) with rain.

Transect I

The first (I) sampling transect (See Figure 4) was a line running 200^{o} south southwest from PSNH telephone pole #7122 toward a large square cement mooring block.

At the upper intertidal area of this transect two areas of relict Spartina alterniflora marsh occupied silty sand pockets among the cobble. These marshes had maximum dimensions of 8.4 by 22.1 meters (185.6 m^2) for the north western portion and easterly an irregular (L-shaped) stand with an area of approximately $81.2m^2$. These marshes contained 12, 10, and 15 individual plants of Spartina alterniflora for three $20cm^2$ grid counts. Six random plant heights were measured (12.2, 14.6, 13.2, 9.0, 11.1 and 14.4 cm). Interpretation of this data indicates a sparse (308.3 individuals per square meter) population, stunted (12.4 cm) in height. The common periwinkle, Littorina littorea was present in mean densities of $100.0/m^2$. The remainder of the transect was devoid of vascular vegetation and was characterized by various elevations of cobble and silt pockets. A small intertidal area east of this transect contained an eelgrass (Zostera marina) panne.

At the mid-tide level, three random 20 cm x 20 cm grids were examined for epifaunal and infaunal biota (Station #1). These were silty-sand areas with an epifaunal component dominated by the periwinkle Littorina littorea in densities averaging $358.2/m^2$. Infaunal excavation to a depth of 20 cm revealed a sandy silt substrate with the upper 1 cm layer of highly oxygenated sediment (redox layer). The samples were examined for macrobenthic organisms by visual examination and no large organisms were recovered.

Two meters east of Station #1, Station #2 was established on a cobbley area of slightly higher elevation than Station #1. The rocky-gravelly-sand substrate had an epifaunal component dominated by the blue mussel, Mytilus edulis, which attained mean densities of 308.2 individuals per square meter and averaging 3.51 cm in length (Ni=37). This station's epifauna also contained approximately 125.0 periwinkles, Littorina littorea, 8.3 green crabs, Carcinus maenas, and 8.3 mud crabs, Rhithropanopeus harrisii, per square meter. Examination of the infaunal components revealed one 4.7 cm Mya arenaria from the three infaunal grids at this station.

Station #3 on Transect I was located at the lowest point of the intertidal zone next to a large, square, cement mooring block. The epifaunal component of this station consisted of approximately 147.2 Littorina littorea per square meter. A vertical profile of the substrate indicated layering of approximately 10 cm of silt over fine sand with a 1 cm redox. Visual examination of a 20 cm x 20 cm x 20 cm (deep) excavation revealed no large benthic organisms.

Transect II

Transect II was established down the beachface behind (west of) the mole breakwater (Figure 4). The transect ran 230^{o} from a telephone pole on Route 1A labeled NHG&E Co. 23-7-125. Station II # 1 on this transect was located at approximately the mid-tide level on gravelly sand. No infauna or epifauna were recorded during sampling.

Station II #2 was located at approximately the low tide level where a very shallow depression allows silt to accrue in this sheltered are (see Figure 4).

The epifaunal census revealed the gastropod, Littorina littorea, was present in densities of approximately 38.7 per square meter. Infaunal examination recovered one 7.6 cm soft-shelled clam, Mya arenaria. The substrate was silty-sand with a 1cm redox layer.

Transect III

Transect III was established across the crescent beach east of the "mole" breakwater (Figure 4). The transect was bearing 160^{o} from a telephone pole on Route 1A labeled NHG&E Co. 23-7-126. At approximately the high tide level, the "weed wash" line (various seaweeds washed up the beach) consisted of Irish moss, Chondrus crispus; rockweeds, Fucus vesiculosis and Fucus spiralis; knotted wrack, Ascophyllum nodosum; hollow stemmed kelp, Laminaria longicruris; and hollow greenweed, Enteromorpha intestinalis.

The tall forest canopy of the disposed area along Route 1A aesthetically isolates the containment site from motorists and patrons of Rye Harbor. Various elevations found within the containment dike make the area a diverse assemblage of flora.

Station III #1 was at approximately the mid-tide mark of this sandy area. This station contained Irish moss, Chondrus crispus and rockweed, Fuscus vesiculosis. There were no epifaunal or infaunal organisms recovered.

Station III #2 was located at approximately the low tide mark. The substrate was 2 cm of silt over fine sand ($\leq$18 cm). The epifaunal grid analyses recovered an average of 146.6 Littorina littorea per square meters. No infaunal organisms were recovered.

Transect IV

Transect IV was located bearing 225° from the steel children's slide in the State Park. The beach face was cobbley and covered with seaweeds. Areas south of the transect (toward the beach where Transect III is located) was predominantly cobble with various densities of the blue mussel, Mytilus edulis. This transect did not contain any mussels.

Station IV #1 was located at approximately the mid-tide level and had a dense (7 cm) cover of seaweeds. Sampling the three epifaunal grids (20 cm x 20 cm) revealed various species including hollow stemmed kelp, Laminaria longicruris; ribbed lace weed, Membranoptera alata; Irish moss, Chondrus crispus; and rockweed, Fucus vesiculosis. Infaunal analysis of these three grids to a depth of 20cm did not recover any macrobenthic invertebrates.

Station IV #2 was established at approximately the low tide level. Examination of the three infaunal and epifaunal (20cm^3) samples also revealed no organisms.

DISCUSSION

Rye Harbor is an estuarine embayment of the New Hampshire coast. All of the harbor has large riprap boulders stabilizing the intertidal/upland interfaces. The intertidal zones are predominantly cobble with some pocket marshes and small areas of sand. Standing at the head of the harbor, e.g. the State pier, there is obvious symmetry between the northern and southern shorelines of the harbor. Both areas have extensive marshes draining into them under access roads (Route 1A bridge and Harbor Point Road bridge). These areas have minimal flow and depth at low tide. Where these marsh creeks enter the harbor, small stands of cordgrass, *Spartina alterniflora*, are eroding. Sandy and cobble intertidal flats fringe the harbor with riprapped shoreland borders.

The northern shoreline was chosen for quantitative field investigations because of its proximity to Route 1A and a State Park. The southern shoreline of this harbor is mostly private. Sampling was conducted on 26 August 1985. The quantitative results from sampling of the north shore is assumed qualitatively applicable to the southern shoreline.

The intertidal habitat of Rye Harbor is dominated by the periwinkle, *Littorina littorea* (87.8 per square meter), on silty-sand substrates and the blue mussel, *Mytilus edulis* (34.2 per square meter), on the cobbly-sand substrates. The dominant macrobenthic infaunal component of this estuary may be the soft-shelled clam, *Mya arenaria*, but is probably present in low densities (1.85 per square meter, 6.15 cm average length from Ni=2). The dominant flora consists of a small relict *Spartina alterniflora* ($266.8m^2$) stand at the head of the harbor and various seaweeds, predominantly *Fucus vesiculosus* and *Ascophyllum nodosum*.

In general, the intertidal areas of Rye Harbor, New Hampshire, are cobbly-sand substrate. The common perriwinkle, *Littorina littorea* and the mussel, *Mytilus edulis* are present in various densities. The steamer or soft-shell clam is present at some stations, but not likely in significant densities.

A 5-minute bird census on 26 August 1985, at mid-ebb tide, identified 9 resting cormorants, *Phalacrocorax auritus*, 8 black-backed gulls, *Larus marinus*, 2 second year herring gulls and 52 mature herring gulls, *Larus argentatus*. The only other shorebird species observed in Rye Harbor was *Charadrius semipalmatus*, the semipalmated plover, a pair of which were feeding on the flats at low tide.

Table 1. Transect I Intertidal benthic organisms sampled in Rye Harbor, New Hampshire. (20 x 20 cm grids, 20 cm deep and sieved through a 1.0 mm screen). 26 August 1986

	#/m²		
	Station #1	Station #2	Station #3
Phylum Mollusca			
Class Gastropoda			
Littorina littorea	358.2	125.0	147.2
Class Bivalvia			
Mytilus edulis		308.2	
Mya arenaria		8.3	
Phylum Arthropoda			
Class Crustacea			
Carcinus maenas		8.3	
Rhithropanopeus harrisii			8.3

Table 2. Transect II Intertidal benthic organisms sampled in Rye Harbor, New Hampshire. (20 x 20 cm grids, 20 cm deep and sieved through a 1.0 mm screen). 26 August 1986

	#/m²	
	Station #1	Station #2
Phylum Mollusca		
Class Gastropoda		
Littorina littorea	0	38.7
Class Bivalvia		
Mya arenaria	0	8.3

Table 3. Transect III Intertidal benthic organism sampled in Rye Harbor, New Hampshire (20 x 20 cm grids, 20 cm deep and sieved through a 1.0 mm screen).

	$\#/m^2$	
	Station #1	Station #2
Phylum Mollusca		
Class Gastropoda		
<u>Littorina</u> <u>littorea</u>	146.6	

Table 4. Transect IV Intertidal benthic organisms sampled in Rye Harbor, New Hampshire. (20 x 20 cm grids, 20 cm deep and sieved through a 1.0 mm screen). 26 August 1986

Comment: No infauna or epifauna recovered.

Table 5. Intertidal benthic organisms sampled in Rye Harbor, New Hampshire. (20 x 20 cm grids, 20 cm deep and sieved through a 1.0 mm screen). 26 August 1986

Phylum Mollusca
Class Gastropoda
<u>Littorina</u> <u>littorea</u> - Common periwinkle

Class Bivalvia
<u>Mytilus</u> <u>edulis</u> - Blue mussel
<u>Mya</u> <u>arenaria</u> - Soft-shelled clam

Phylum Arthropoda
Class Crustacea
<u>Carcinus</u> <u>maenas</u> - Green crab
<u>Rhithropanopeus</u> <u>harrisii</u> - White-fingered mud crab

APPENDIX III

Concentrations of PCB

Modified Elutriate Test Results (Palermo, 1986)

I. Filtered Sample (centrifugation)

<0.05 ppb
0.06 ppb
0.05 ppb

avg. 0.053 ppb = 0.000053 mg/l

II. Suspended Solids

202 ppm
205 ppm
202 ppm

avg. 203 mg/l

III. Unfiltered Sample

0.13 ppb
<0.05 ppb
<0.05 ppb

avg. 0.077 ppb = 0.000077 mg/l

1. The dilution factor (EPA/Corps, 1977) = 36
2. The volume of discharge = 7,646.4m^3
3. Required mixing zone to attain 0.041 ppb = 275,740.4m^3
4. Available mixing zone in Rye Harbor below MLW = 289,569.6m^3

Therefore, the weir discharge over 6 hours will increase the receiving waters by 1 part per trillion in 92.2% of the water.

ELUTRIATE TEST RESULTS
RYE HARBOR, NEW HAMPSHIRE

In February 1986 water samples were taken from both the outer and inner harbor and tested for PCB's. An elutriate test was performed on a grab sample taken at the upstream end of the channel (location F) where the bulk chemical analysis had indicated the highest concentration of PCB's (610 ppb). The results of this work are shown below. Sample locations are shown on the attached map.

Sample Location	Water		PCB (ppb) Elutriate
A	<0.03 <0.03 <0.03		
F	<0.03 <0.03 <0.03		0.15 0.18 0.08
blank		<0.03 <0.03 <0.03	

Core samples were taken in May 1986 from locations C and F. The standard elutriate test was performed on these samples along with a modified elutriate test on the sample from location F. This modified test detects contaminants contained in the suspended sediment and better represents the conditions present during a hydraulic dredging operation. These results are shown below:

Sample Location	Water		PCB (ppb Elutriate
C	0.04		
blank		<0.02	
0" - 4"			0.04 0.04 <0.02
5" - 9"			<0.02 <0.02 <0.02
F	0.04		
blank		<0.02	
0" - 4"			0.08 0.04 0.39
5" -9"			0.04 0.02

Modified Elutriate Test
(location F)

PCB (ppb) Filtered Sample (centrifugation)	Unfiltered Sample
<0.05	0.13
0.06	<0.05
<0.05	<0.05

suspended solids ppb (unfiltered sample) 202, 205, 202 water <0.05 ppb PCB

APPENDIX IV
CADS Data

Table II.A-1

pH Levels In CADS Water Samples

	Depth (m)	May 1985	September 1985	January 1986
Surface	1	8.15	8.05	7.82
Middle	24	8.14	8.04	7.92
Bottom	47	8.15	7.89	7.78

Table II.A-2

Dissolved Oxygen Concentrations (mg/1) In CADS Water Samples

	Depth (m)	May 1985	September 1985	January 1986
Surface	1	10.3 +/- 1.4[1](8.7)[2]	10.9 +/- 0.6(7.8)	—[3]
Middle	24	9.8 +/- 0.2 (9.5)	9.5 +/- 0.7(8.6)	—
Bottom	47	10.1 +/- 0.9 (9.8)	7.1 +/- 0.3(9.0)	—

1-Mean +/- standard deviation of 3 analyses.

2-Oxygen saturation value for the salinity and temperature of the seawater sampled (Kester, 1975).

3-Analytical problems encountered.

Table II.A-3

Nutrient Concentrations In CADS Water Samples (ppm)

	Depth (m)	May 1985	September 1985	January 1986
Surface	1			
PO_4-P		<0.01	0.02	0.05
NO_3/NO_2-N		0.02	0.03	0.20
NH_3-N		0.034	0.36	0.28
Middle	24			
PO_4-P		0.01	0.02	0.03
NO_3/NO_2-N		0.01	0.09	0.23
NH_3-N		0.27	0.30	0.20
Bottom	47			
PO_4-P		0.01	0.03	0.04
NO_3/NO_2-N		0.01	0.21	0.25
NH_3-N		0.26	0.30	0.32

Table II.A-4

Trace Metal Concentrations In CADS Seawater Samples (ppb)

	Depth (m)	May 1985	September 1985	January 1986
Surface	1			
Lead		<1.5	<2	<1.5
Cadmium		*	*	<0.2
Chromium		<0.5	<1.5	<0.3
Nickel		*	N.A.	N.A.
Copper		*	<2	<1.0
Zinc		<20	<20	<2.0
Arsenic		<2.0	<3	2.6
Mercury		<0.5	<1	2.2
Middle	24			
Lead		<1.5	<2	<1.5
Cadmium		*	*	<0.2
Chromium		<0.5	<1.5	<0.3
Nickel		5.0	N.A.	N.A.
Copper		<5	<2	1.0
Zinc		<20	<20	<20
Arsenic		<2.0	<3	1.1
Mercury		<0.5	<1	2.1
Bottom	47			
Lead		<1.5	<2	<1.5
Cadmium		*	*	<0.2
Chromium		<0.5	<1.5	<0.3
Nickel		5.0	N.A.	N.A.
Copper		<5	<2	1.2
Zinc		<20	<20	<20
Arsenic		<2.0	<3	2.2
Mercury		<0.5	2.4	2.2

*Sample contaminated.

N.A. - Not analyzed

Table II!A-5

Trace Organic Concentrations In CADS Bottom Water Samples (ppb)

	May 1985	September 1985
Total PAH	<20	N.A.
PCB (dissolved)	0.0019	*
PCB (particulate)	<0.005	*

N.A. - Not Analyzed.
*Sample contaminated.

Table II.B-1

Trace Metal Concentrations In CADS Sediment Samples (ppm Dry Weight)

	Reference May 1985	Reference September 1985	South September 1985	Reference January 1986
Arsenic	5.0+/-0.5[1]	6.6+/-1.6	4.3+/-1.0	7.0+/-1.6
Lead	<19	34+/-14	39+/-10	52+/-4
Zinc	49+/-2	50+/-10	66+/-10	64+/-23
Chromium	27+/-4	33+/-2	35+/-9	34+/-4
Copper	<7	12+/-1	12+/-4	16+/-1
Cadmium	<4	<3	<3	<3
Nickel	<26	<24	<25	<24
Mercury	<0.05	0.15+/-0.10	<0.1	0.09+/-0.03

[1]Mean +/- standard deviations of triplicate analyses.

Concentrations As Dry Weight

	Reference May 1985	Reference September 1985	South September 1985	Reference January 1986
Total Carbon, %	1.16+/-0.06[1]	1.28+/-0.25	2.43+/-0.10	1.47+/-0.26
Total Hydrocarbon, %	0.32+/-0.03	0.32+/-0.06	0.43+/-0.06	0.38+/-0.04
Total Nitrogen, %	0.14+/-0.01	0.14+/-0.02	0.24+/-0.03	0.16+/-0.03
Ammonia, ppm	298[2]	N.A.	N.A.	N.A.
Oil and Grease, ppm	66+/-8	121+/-38	298+/-72	185+/-51
Petroleum Hydrocarbons, ppm	43+/-5	110+/-25	243+/-118	169+/-43
PAH, ppm	<3	N.A.	N.A.	N.A.
PCB, ppb	10.2+/-4.3	43[2]	<10	75+/-34
DDT, ppb	<1	N.A.	N.A.	N.A.

1 - Mean +/- standard deviations of triplicate analyses.

2 - Mean of duplicate anlyses.

N.A. - Not analyzed

Table III.B-9

Summary Of Species (Mean No./m^2) For Each Station And Season At CADS.
(Results are based on three 0.1m^2 grab samples sieved to 0.5mm)

Location Date	North Site Sept'85	South Site Sept'85	Ref Site May'85	Ref Site Sept'85	Ref Site Jan'86
SPECIES NAME					
Actinidae					
Anemone A	.	7	.	3	.
Cerianthanidae					
Cerianthus borealis	.	.	3	.	3
Corymorphiidae					
Heteractis aurata	.	.	76	.	.
Edwardsiidae					
Edwardsia sp.	.	.	28	.	24
Halcampidae					
Halcampa duodecimcirrata	3	80	.	39	3
RHYNCHOCOELA					
Rhynchocoela A	.	.	10	.	10
Rhynchocoela B	.	.	7	.	.
Rhynchocoela sp.	.	.	3	.	3
Lineidae					
Cerebratulus sp.	.	.	3	.	.
Micrura RS	.	.	6	.	3
PLATYHELMINTHES	.	.	.	.	3
PHORONIDA					
Phoronis sp.	.	.	24	.	87
SIPUNCULIDA					
Sipuncula sp.	.	.	10	.	.
Edwardsiidae					
Phascolion strombi	7	.	.	.	3
ANNELIDA					
Oligochaeta sp.	4250	8958	5243	1765	4162

Table III.B-9 continued.

Polychaeta					
Unknown polychaete B	31	.	.	.	.
Unknown polychaete C	3	.	.	.	.
Unknown polychaete D	3	.	.	.	.
Ampharetidae					
Ampharete acutifrons	.	.	.	.	3
Ampharete arctica	622	18	.	7	.
Ampharetidae (juv.)	.	.	.	.	3
Ampharetidae spp.	.	.	.	3	3
Asabellides oculata?	7	.	.	3	.
Melinna cristata	.	3	83	3	.
Aphroditidae					
Aphrodita hastata	.	.	.	3	.
Apistobranchidae					
Apistobranchus tullbergi	844	76	14	10	39
Capitellidae					
Capitella capitata	94	104	.	31	24
Heteromastus filiformis	.	.	24	.	.
Mediomastus ambiseta	518	285	177	198	563
Cirratulidae					
Chaetozone setosa	.	.	518	.	188
Tharyx sp.	2259	167	549	649	1001
Dorvilleidae					
Stauronereis sp.	.	.	7	.	.
Flabelligeridae					
Brada villosa	3	.	.	.	.
Diplocirrus hirsutus	3	42	45	28	14
Pherusa affinis	.	.	21	.	.
Goniadidae					
Goniada maculata	14	3	.	10	10
Goniada sp.	.	.	3	.	.
Lumbrineridae					
Lumbrineris fragilis	125	70	91	107	83
Lumbrineris tenuis	24	.	.	.	.
Ninoe nigripes	122	70	34	42	83
Maldanidae					
Clymenella torquata	.	.	.	.	3
Maldane sarsi	844	42	174	396	1112
Maldanidae sp.	.	.	7	3	.
Maldanidae sp. 1	.	.	.	.	31
Maldanidae sp. 2	.	.	.	.	3
Praxiella gracilis	7	3	.	34	.

Table III.B-9 continued.

Nephtyidae					
Aglaophamus cincirrata	177	167	.	177	.
Aglaophamus neotenus	.	.	.	.	3
Nephtys incisa	83	170	232	132	80
Nephtyidae sp.	.	.	.	.	59
Nephtys sp.	.	.	.	.	21
Nereidae					
Nereis sp.	.	.	3	.	3
Nereis virens	3	.	.	.	.
Orbiniidae					
Orbinidae sp.	52	39	.	3	.
Scoloplos acutus	316	170	.	66	70
Scoloplos sp.	.	.	101	.	.
Oweniidae					
Myriochele oculata	500	670	698	670	1400
Owenia fusiformis	232	49	3	112	143
Paraonidae					
Aricidea catherinae	354	76	3	.	.
Aricidea quadrilobata	225	188	868	407	472
Aricidea suecica	.	49	.	.	.
Levinsenia gracilis	365	299	201	170	316
Pectinariidae					
Cistena granulata	3	.	.	.	.
Cistena sp.	.	.	.	.	3
Phyllodocidae					
Eteone longa	257	347	.	112	97
Eteone trilineata	.	.	112	.	.
Phyllodoce groenlandia	3	.	.	.	.
Phyllodoce mucosa	42	198	.	45	14
Polynoidae					
Harmothoe extenuata	.	.	91	.	.
Harmothoe imbricata	59	7	.	14	.
Hartmania moorei	14	.	7	3	10
Sabellidae					
Euchone incolor	310	271	1091	201	456
Laonome sp.	3	.	.	3	10
Potamilla sp.	.	.	3	.	.
Scalibregmidae					
Scalibregma inflatum	7	.	10	3	7
Sigalionidae					
Pholoe minuta	285	383	107	226	188

le III.B-9 continued.

aerodoropsis					
aerodoropsis minuta	3	3	.	10	14
onidae					
nice sp.	3	.	.	.	.
ydora socialis	.	.	7	.	.
ydora sp.	94	28	.	3	3
ynoidae sp.	3	3	.	.	.
onospio steenstrupi	1908	545	1324	326	1066
.o pettibonae	1108	907	743	362	358
.onidae sp.	3	.	.	.	.
.ophanes bombyx	3	.	.	.	.
ernaspidae					
ernaspis fossor	556	904	660	358	646
llidae					
tolytus sp.?	.	66	.	.	.
ogone hebes	14	10	.	3	7
ogone longocirrus	7	.	.	.	.
ogone verugera profunda	14	.	10	14	39
llis cornuta?	.	.	.	.	18
llis gracilis	3	.	.	.	.
llis sp.	7	3	10	3	7
llidae sp.	3	.	.	3	3
phitrite sp.	.	.	.	7	.
lycirrus medusa	.	.	42	.	.
lycirrus sp.	.	.	.	.	3
rebellidae					
rebellides stroemi	18	.	31	7	7
rebellidae sp.	18	31	24	49	39
ochochaetidae					
ochochaeta carica	.	.	.	.	3
ochochaeta multisetosa	18	31	.	10	10
OLLUSCA					
placophora					
rystallophrissonidae					
haetoderma nitidulum	21	.	21	18	21
caphopoda					
caphopoda sp.	.	.	10	.	.
entaliidae					
entalium entale stimpsoni	.	.	.	7	7
ivalvia					
ivalvia A	.	.	.	.	21
ivalvia unknown	7	.	24	.	49

Table III.B-9 continued.

.rcticidae					
Arctica islandica	73	55	101	97	107
Astartidae					
Astarte undata	139	3	21	70	66
Cardiidae					
Cerastoderma pinnulatum	7	.	83	18	3
Hiatellidae					
Hiatella arctica	7	.	.	3	.
Lyonsiidae					
Lyonsia hyalina	7	.	.	.	.
Mytilidae					
Crenella decussata	132	14	132	149	159
Modiolus modiolus	14	3	.	.	.
Musculus niger	.	.	.	3	.
Myidae					
Sphenia sincira	153	125	800	431	299
Nuculanidae					
Nuculana tenuisculata	.	.	7	.	.
Yoldia sapotilla	24	.	28	21	14
Nuculidae					
Nucula annulata	3	.	.	.	.
Nucula proxima	3	7	14	.	.
Nucula delphinodonta	935	368	622	1017	876
Nucula tenuis	76	70	76	73	73
Pectinidae					
Plactopecten magellanicus	.	.	3	.	3
Periplomatidae					
Periploma papyratium	91	7	188	185	240
Periploma sp.?	.	.	.	.	3
Solemyacidae					
Solemya sp.	.	14	.	.	.
Tellinidae					
Macoma balthica	.	.	52	.	.
Macoma calcarea	31	34	.	167	.
Thyasiridae					
Thyasira elliptica	.	.	.	10	.
Thyasira flexuosa	94	31	462	341	407

Table III.B-9 continued.

Veneridae					
Pitar morhuanna	.	.	.	.	3
Gastropoda					
Unknown gastropod	3	.	.	.	.
Gastropoda sp.	.	7	.	.	.
Retusidae					
Retusa obtusa	45	.	.	34	21
Rissoidae					
Alvania pelagica	.	.	.	18	14
Scaphandridae					
Cylichna alba	.	.	18	.	.
Cylichna gouldii	3	.	.	.	.
Turridae					
Oenopota sp.	10	7	.	3	.
Propebela sp.	.	.	.	14	.
ARTHROPODA					
Crustacea					
Amphipoda					
Amphipod A	.	3	.	.	.
Ampeliscidae					
Ampelisca agassizi	.	.	.	.	24
Ampelisca macrocephala	18	.	.	3	.
Haploops tubicola	76	.	42	7	39
Argissidae					
Argissa hamatipes	45	7	11	3	.
Caprellidae					
Aeginina longicornis	.	3	.	.	.
Caprellidae sp.	.	.	.	.	3
Corophiidae					
Erichthonius rubricornis	.	.	.	.	10
Gammaridae					
Casco bigelowi	3	.	.	10	101
Lysianassidae					
Anonyx lilljeborgi	18	21	3	7	.
Hippomedon propinquis	.	.	.	.	7
Hippomedon serratus	.	.	3	.	.
Orchomenella pinguis	.	.	.	3	.

Table III.B-9 continued.

Oedicerotidae					
Oedicerotidae sp.	10	.	.	.	.
Synchelidium americanus	.	.	14	.	.
Photidae					
Photis macrocoxa	70	18	.	31	115
Photis reinhardi	.	.	59	.	.
Phoxocephalidae					
Harpinia propinqua	7	.	3	10	18
Pleustidae					
Stenopleustes gracilis	.	.	.	3	.
Stenopleustes inermis	.	.	18	.	24
Podoceridae					
Dulichia monocantha	.	.	107	.	.
Dulichia porrecta	.	.	87	.	.
Dulichia sp.	14	3	.	3	3
Stenothoidae					
Metopella angusta	18	.	7	21	.
Cumacea					
Diastylidae					
Diastylis goodsiri	.	.	10	3	7
Diastylis quadrispinosa	31	42	24	34	.
Diastylis sculpta	42	28	.	39	.
Diastylis sp.	.	.	7	.	.
Diastylis sp. A	.	.	.	.	42
Leptostylis ampullacea	.	.	3	.	3
Leptostylis longimana	.	18	39	18	21
Leuconidae					
Eudorella truncullata	21	3	101	24	66
Nannastacidae					
Campylaspis sp.	107	18	49	59	18
Isopoda					
Anthuridae					
Ptilanthura tenuis	10	.	.	21	3
Idoteidae					
Edotea triloba	310	10	31	97	34
Decapoda					
Portunidae					
Carcinus maenas	.	3	.	3	.

Table III.B-9 continued.

ECHINODERMATA					
Cucumariidae					
Thyone sp.	3	.	.	.	.
Ophiuridae					
Ophiura sarsi	31	3	28	49	18
Phyllophoridae					
Pentamera calcigera	.	.	.	3	3
Pentamera sp.	3	.	.	.	.
HEMICHORDATA					
Harrimaniidae					
Stereobalanus canadensis	.	.	3	.	.
CHORDATA					
Molgulidae					
Bostrichobranchus pilularis	.	.	21	.	.
Molgula sp.	3	3	.	31	.

TABLE III-B.10

Summary Of Total Number Of Species
And Individuals/m^2 Per Station Per Season At CADS

SITE AND COLLECTION DATE		MEAN # INDIVIDUALS	NO. OF SPECIES
North Site	Sept. 1985	19,579	100
South Site	Sept. 1985	16,472	70
Ref Site	May 1985	16,867	90
Ref Site	Sept. 1985	9,999	92
Ref Site	Jan. 1986	15,976	99

Table III.B-11

Numbers Of Species And Individuals For 0.1m²
Smith/McIntyre Samples, CADS,
September 1985

	Taxa/Sample				Individuals/Sample		
Station	Sieve Size	1.0	0.5	Total	1.0	0.5	Total
North	A	57	60	78	621	1527	2148
	B	59	40	68	882	911	1793
	C	73	45	77	1271	640	1911
				74.3±5.5			1951±181
South	A	37	47	61	420	1842	2262
	B	46	35	54	656	717	1373
	C	51	21	51	815	406	1221
				55.3±5.1			1620±561
Ref	A	45	43	65	258	480	738
	B	56	36	66	508	415	923
	C	59	48	74	608	694	1302
				68.3±4.9			988±288

Table III.B-12

Mean Density Of Oligochaetes, And Top 3 Species Of Polychaetes, Crustaceans and Molluscs (plus *Arctica*) Per Season At The Reference Station At CADS.

REFERENCE STATION
MAY 1985

SPECIES	MEAN DENSITY #/m^2
OLIGOCHAETA	5243
POLYCHAETA	
Prionospio steenstrupi	1324
Euchone incolor	1091
Aricidea quadrilobata	868
MOLLUSCA	
Sphenia sincira	800
Nucula delphinodonta	622
Thyasira flexuosa	462
Arctica islandica	101
CRUSTACEA	
Dulichia monocantha	107
*Eudorella truncula*ta	101
Dulichia porrecta	87

REFERENCE STATION
SEPTEMBER 1985

SPECIES	MEAN DENSITY #/m^2
OLIGOCHAETA	1765
POLYCHAETA	
Myriochele oculata	670
Tharyx sp.	649
Aricidea quadrilobata	407
MOLLUSCA	
Nucula delphinodonta	1017
Sphenia sincira	431
Thyasira flexuosa	341
Arctica islandica	97
CRUSTACEA	
Edotea triloba	97
Campylaspis sp.	59
Diastylis sculpta	39

REFERENCE STATION
January 1986

SPECIES	MEAN DENSITY #/m^2
OLIGOCHAETA	4162
POLYCHAETA	
Myriochele oculata	1400
Maldane sarsi	1112
Prionospio steenstrupi	1066
MOLLUSCA	
Nucula delphinodonta	876
Thyasira flexuosa	407
Sphenia sincira	299
Arctica islandica	107
CRUSTACEA	
Photis macrocoxa	115
Casco bigelowi	101
*Eudorella truncula*ta	66

Table III.B-13

Rank Abundance Of Top Ten Species
At Reference Station Per Season at CADS

May 1985		Mean no./m^2
1.	OLIGOCHAETA	5030
2.	Prionspio steenstrupi	1324
3.	Euchone incolor	1091
4.	Aricidea quadrilobata	868
5.	Sphenia sincira	800
6.	Spio pettibonae	743
7.	Myriochele oculata	698
8.	Sternaspis fossor	660
9.	Nucula delphinodonta	622
10.	Tharyx sp.	549

Sept. 1985		Mean no./m^2
1.	OLIGOCHAETA	1765
2.	Nucula delphinodonta	1017
3.	Myriochele oculata	670
4.	Tharyx sp.	649
5.	Sphenia sincira	431
6.	Aricidea quadrilobata	407
7.	Maldane sarsi	396
8.	Spio pettibonae	362
9.	Sternaspis fossor	358
10.	Thyasira flexuosa	341

Jan 1986		Mean no./m^2
1.	OLIGOCHAETA	4162
2.	Myriochele oculata	1400
3.	Maldane sarsi	1112
4.	Prionospio steenstrupi	1066
5.	Tharyx sp.	1001
6.	Nucula delphinodonta	876
7.	Sternaspis fossor	646
8.	Mediomastus ambiseta	563
9.	Aricidea quadrilobata	472
10.	Euchone incolor	456

TABLE III.B-14

Mean Density Of The Five Dominant Species From Each Station At CADS, September 1985

NORTH SITE

SPECIES	#/m^2
Oligochaeta	4250
Tharyx sp.	2259
Prionospio steenstrupi	1908
Spio pettibonae	1108
Nucula delphinodonta	935

SOUTH SITE

Oligochaeta	8958
Spio pettibonae	907
Sternaspis fossor	904
Myriochele oculata	670
Prionospio steenstrupi	545

REFERENCE SITE

Oligochaeta	1765
Nucula delphinodonta	1017
Myriochele oculata	670
Tharyx sp.	649
Sphenia sincira	431

Table III.A-2

Total Fish and Shellfish Catch from the Four Net Deployments at CADS in September 1985

(The total number of individuals caught, as well as the community profile; e.g. juvenile, adult or spawning (J,A,S) is given)

SPECIES		
Dogfish (Squalus acanthias L.)	144	A
Thorny skate (Raja radiata Donovan)	8	A
Smooth skate (Raja senta Garman)	15	A
Longhorn sculpin (Myoxocephalus octodecemspinosus Mitchell)	5	A
Sea raven (Hemitripterus americanus Gmelin)	1	A
Red hake (Urophysis chuss Walbaum)	10	J,A
Silver hake (Merluccius bilinearis Mitchell)	9	J,A,S
Mackerel (Scomber scombrus L.)	1	?
Butterfish (Peprilus triacanthus Peck)	41	J
Winter flounder (Pseudopleuronectes americanus Walbaum)	2	A
Wolffish (Anarhichas lupis L.)	1	A
Goosefish (Lophius americanus Valenciennes)	2	A
Blueback herring (Alosa aestivalis Mitchell)	2	J
Lobster (Homarus americanus)	15	A
Cancer crab (Cancer borealis Stimpson)	111	J,A
Green crab (Cancinus maenas L.)	1	A

II. Finding of No Significant Impact

The dredging and ocean disposal of approximately 85,000 cubic yards of sand and silty material from Rye Harbor has been determined to impart no significant impact on the ecosystem.

This assessment has been prepared in accordance with the National Environmental Policy Act of 1969 and all applicable environmental statutes and executive orders. My determination that an Environmental Impact Statement is not required is based upon the information contained in the Environmental Assessment and the following considerations:

a. The project will not affect any State or Federal rare, threatened or endangered species pursuant to the Endangered Species Act.

b. Based on physical and chemical analyses, the material in the project area will have no significant adverse effect upon existing water quality in the dredging or disposal areas.

c. A temporary impact will be caused by removal of benthic organisms from the Federal channel by dredging operations. These organisms will be replaced by recolonization from adjacent areas and larval recruitment within 2 or 3 years.

d. As a result of coordination with the State Historic Preservation Office, it has been determined that no cultural resources will be impacted by the proposed dredging or disposal.

Based on my review and evaluation of the environmental effects as presented in the environmental assessment, I have determined that this Rye Harbor maintenance dredging project is not a major Federal action significantly affecting the quality of the human environment. Therefore, this action is exempt from requirements to prepare an environmental impact statement.

7 APR 89
Date

Daniel M. Wilson
DANIEL M. WILSON
Colonel, Corps of Engineers
Division Engineer